DEC 26 1912

JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXIX NO. 25 SAN FRANCISCO, DECEMBER 21, 1912 PER COPY 25 CENTS

The Season's Greetings from the

Pacific States Electric Co.

The Modern Electrical Supply House

We will be in our new
San Francisco home
575-77-79 Mission St.,
on and after
December 23, 1912
where we will be
glad to greet our patrons
and friends.

Building will be open
for inspection Monday
evening, Dec. 23, 1912
from 7:30 to 10 p. m.

THE PACIFIC STATES
ELECTRIC CO
SERVES THE
PACIFIC COAST

Other houses in

OAKLAND PORTLAND
LOS ANGELES SEATTLE

OUR NEW HOME

Where to Buy It in the West, Pages 9, 10. Alphabetical Index to Advertisers, Page 8.

During Winter when the weather is cold and blustery and you keep the doors and windows shut tight — that's the time for

G-E OZONATORS

¶ They keep indoors fresh and sweet by the production of ozone in sufficient quantities to purify and cleanse the atmosphere. G-E Ozonators provide an economical and effective method of ventilation.

¶ They cleanse the air without setting up draughts and can be easily and conveniently installed to any fixture, occupy a small amount of space and operating cost is nominal.

¶ Invaluable in the home, in hospital wards, public halls, school rooms, and other enclosed places where good ventilation is essential to health and comfort.

Let us tell you more about them

PACIFIC STATES ELECTRIC CO.

The Modern Electrical Supply House
Distributors for the Pacific Coast

SAN FRANCISCO OAKLAND LOS ANGELES PORTLAND SEATTLE

THE PACIFIC STATES
ELECTRIC CO.
SERVES THE
PACIFIC COAST

B273305

JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXIX SAN FRANCISCO, DECEMBER 21, 1912 NUMBER 25

[COPYRIGHT 1912 BY TECHNICAL PUBLISHING COMPANY]

ILLUMINATION OF THE PANAMA-PACIFIC EXPOSITION

BY W. D'A. RYAN.[1]

I do not wish to give the impression that I am going to take up time with a technical discussion on light. I will, however, explain a few of the fundamental features in an elementary way; those things which have to do primarily with this Exposition lighting. In the first place, it raises the question, "What is light?" Light is a wave motion, as we understand it. The sun, for instance, sends out innumerable waves that travel through the ether, which fills all space. These waves travel at the speed of 182,582 miles per second, but they vibrate at various rates. Light, therefore, is a vibration. We can measure the rate of the vibration. There are many waves leaving the sun, and when a wave once starts, it goes on forever, unless it strikes something. As the ray strikes and re-radiates it produces the effect of color, or light.

It is difficult to realize the enormous speed of light. The alternating current used for lighting is 60 cycles. The electricity leaves the mountains, passes through all the wires, through our lamps, our toasters, our flatirons, etc., and returns to the dynamo. This is done 132 times a second; you think this is rapid, but it is slow compared to the velocity of light. For instance, there are some stars so far away that if a ray of light left the earth at the beginning of the Christian era, it would not have reached them yet.

Arc Lamp and Other Demonstrating Apparatus.

We will be able to show you in a few minutes how we can measure the velocity of stars. We have these light waves, and the longest rays coming from the sun are heat waves. They are too long to be seen. We start with a vibration of red, vibrating at the rate of 424,000,000 million times per second. The shortest is violet, vibrating at the rate of 728,000,000 million times a second. Green comes between the two, so that we have three waves with which we can produce all the colors of nature. The accepted theory is that all matter is in a constant state of vibration, or is ready to go into vibration.

Suppose I throw a spot of white light on a screen, and that I next pull that spot apart and show you all the colors it contains. Here is a little piece of ma-

[1]Illuminating Engineer, Panama-Pacific Exposition.

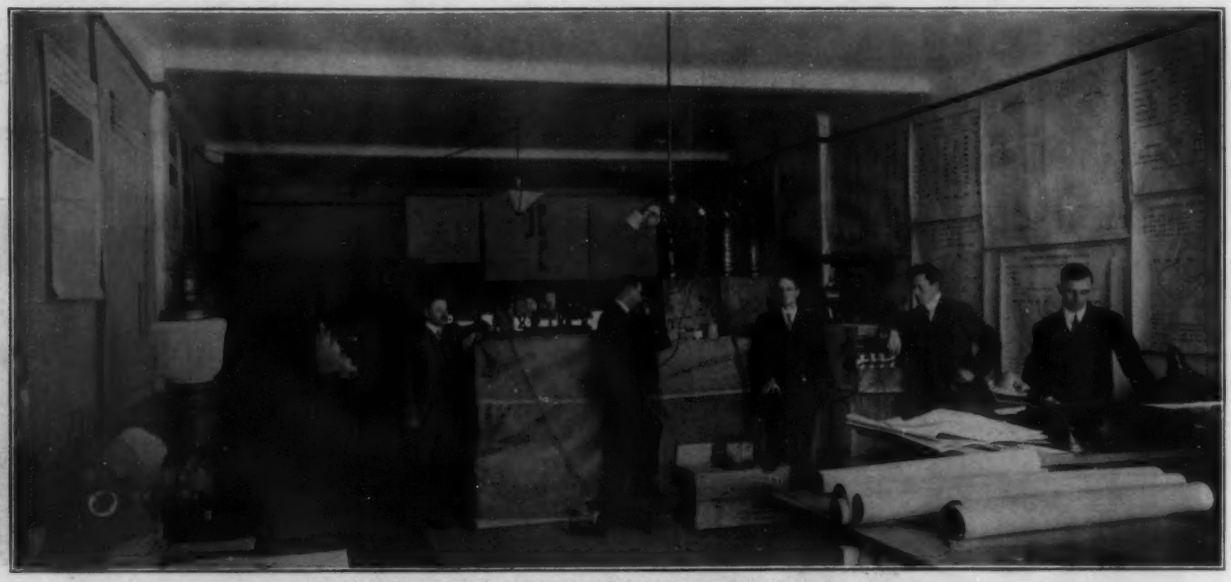
terial; that is red, because all the rays go into that material except the long, or red waves. If light did not contain long rays, there would be no sensation of red given back from it. You look; you say it is red. You receive that vibration precisely in the same way as though you struck a tuning fork near a piano; the wire in the piano whose note corresponds to the note of the tuning fork will vibrate when the fork is struck. The light strikes this and it sets up a vibration that corresponds to the vibration of red. I will put this in a light where there are no long rays, and it will be black. No object is colored in itself; it merely possesses the ability to radiate the rays as received from the sun.

I stated before that we had three fundamental waves; red, green and violet. If we have waves containing these different rays, we can produce every color in nature. Red and green make yellow; green and violet make blue; violet and red make purple. Now put light yellow and blue together, and you get white. An artist who works in pigments will not understand them. The reason is that an artist is dealing with an impurity in mixing his pigments. If we have a yellow pigment, a light containing all the rays falls into it, and they are all destroyed except the yellow and possibly some impure color. We take our yellow pigment, and we take our blue pigment; but we know that the yellow contains a little bit of green, the blue contains a little bit of green also. We mix the two pigments together, and the result is all you get is the impurity in both colors, which is green. Now we, on the other hand, are dealing in light, which is pure; therefore, when we mix yellow and blue we get white.

We take a beam of white light, and we will separate the colors. We will make the long rays go in one direction; the shorter the ray, the further out it will be spread from a certain definite point. Here we have a white beam of light spread out; here are your long waves, your intermediate and your short ones. If you place a white object in these lights, it will take the color of each light that falls upon it; if you put a black object in there, it will be black, no matter where you put it. If no wave lengths are sent back, it is black; if all are sent back, it is white.

The spectrum is crossed by little lines grouped in a certain way, and always grouped the same, so that from the spectrum we can tell exactly the composition of the planets and the velocity of the stars. Now if a star is traveling in the direction of the earth, this line will be pushed out of place; if the star is going way from the earth, it will be pushed in the other direction.

All these things have more or less bearing on our subject. I will show you a few interesting experiments with different colored lights. These lights are not lights colored up with any materials to make them look different; they are the actual lights used everywhere, for commercial purposes and in the homes.



W. D'A. Ryan and Assistants With Demonstrating Apparatus.

Here is the intensified arc lamp, which gives the nearest approach to daylight of any artificial light in commercial use. This will show the effect of gas; we could not get gas in here, and were obliged to use gasoline, which answers the purpose. This is the mercury arc; this is the Mazda, this is the Corrected Mazda, and here we have the ordinary carbon lamp, which is quite yellow. It has frequently happened in this case that the salesmen have told you that this is a white light; they call everything white when it comes out, but when you come right down to it you find it is quite decidedly on the yellow. The material is the same in every booth; it is the color of the light that makes them look different. Every object takes the color of the light which strikes it; it was no color in itself. We may produce a beautiful effect in flowers, but moonlight may kill the effect; so we much watch very carefully the balance of color.

Interesting experiments are easily devised showing the effects of the different lights on a red poinsettia, violets and carnations, showing that a flower will appear in its natural colors under one light, look black under another, and its color will be intensified under yet another. For instance, I may exhibit a few

pieces of material under the different lights. These pieces of silk and wool are an absolutely perfect match; but I am going to show you how they would look if you purchased them under any of these lights. Under one light they will appear green and gray; in here you will get a different comibnation. Artificial lights are not all alike; some have too much green, some too much yellow. It is impossible to distinguish very pale green from white in a green light, or very pale yellow from white in a yellow light. (Showing a piece of plaid.) No matter what clan you belong to, you can take your plaid off this one piece. The white material is the one which tells the whole story. This is the way a piece of white material would look if you purchased it under any one of these lights.

I refer to these illustrations largely to show that we have lights of all colors, and we can use the ones desired to maintain any particular color. For instance, the question of ground surface is interesting. We do not wish to produce too light a color in the concrete or whatever material is used. Most of the expositions have been pretty bright, and people go in tired and have headaches, and the worst light of all is the one that comes up from the ground.

As to the question of flags; we do not want to produce a light which destroys their effect. As to the question of wall surface; if you make that surface rough instead of flat, you will increase the effect of illumination at least 50 per cent.

Let me illustrate with straight and crooked lines drawn on a blackboard the effect of light on flat and rough wall surfaces. Now the light strikes this surface (flat) and it scatters in different directions, and a good deal of it will go up like that, and not be returned direct to the eye. That is particularly true if it is a shiny surface, which, I presume, it will not be. If it is a shiny surface, it will be almost impossible to get the light effect on it that you are looking for.

Our scheme of illumination will be entirely different from anything ever done before. The advance in electrical science within the last ten years will enable San Francisco to illuminate her fair buildings, inside and out, in an entirely new way. There will be no glare, no dark places. This will be taken care of by means of indirect lights and concealed batteries. The method is a combination of direct and indirect illumination. Instead of outline lighting, we aim at a general illumination.

In place of incandescent lamps, we will use jewels where we want to emphasize. The jewels to be used for the Exposition vary in size from a marble to six inches. There is a vast difference between a glass doorknob and a scientifically cut jewel. This jewel is full of life; this is a poorly cut one, and we merely show it to illustrate the difference between jewels that are poorly cut and those that are scientifically cut.

They are cut for different distances and effects, and some are cut in this country and others abroad. They are just glass of a special cutting. It is rather strange to find that the glass cutters and jewelers had never cut anything in that size before, and it was entirely new to them. It was absolutely necessary for us to measure the index of refraction of the glass. This cutting is about right for 1000 yards, and here is one which is at its best at a distance of 2000 yards. Viewed from this side it looks like a piece of ice; from the other side it appears like a ring of light, which from a distance becomes a point.

Demonstrating Shadow Effects and Color Changes.

These jewels cost no more than to operate incandescent lamps. In the sunlight they are dead; they will not be active. That does not mean that we will not get an occasional flash, but it will not be at all objectionable.

The Main Court will be surrounded by a row of figures 14 feet high, and the head of each figure will be crowned with a star measuring four feet across. These stars will be studded with jewels, which will pick up the light from the opposite side of the court and twinkle like diamonds. Lights will be played upon these jewels from masked batteries on the roofs of the buildings.

If we take a notion to change the color of some of these stones, it will not be at all difficult; we simply back the stone with the color which we desire. There is nothing so beautiful as a white stone, however.

For the Court of Jewels I have had some imitation

pearls made in Fostoria. You notice the different sizes; they can be strung according to size. It is a very good imitation, and the effect is as good as you can make. It is on the Tiffany order without the Tiffany prices. The light must strike them from the outside; the effect of lighting them from the inside would be to turn them a dirty yellow. Take a little soap bubble, and throw a light on the side of that bubble and show the iridescent colors such as you see in insects' wings. As the colors change you get all sorts of effects; one effect is like a Paisley shawl. I am working on a machine to blow bubbles by the thousand and throw lights on them, but it does not look very encouraging yet.

In the supplement to this issue of the Journal is found a reproduction of the proposed illumination at the Exposition. The method I propose is a combination of direct and indirect lighting, and not altogether concealed. The direct light will be the light on the facades, bringing out the color values in the proper relations, and the light behind the columns will be a scintillator, which will be mounted off the main axis of the Exposition, about 500 or 600 yards out in the water. It will be placed on barges anchored in the bay, and will require sixty trained men to operate the lights. These men will be drilled, and the effect will be marvelous. They will go through an evolution of color, forming auroras and various effects in the sky and over the Exposition, and will spread like a great lily. This will be seen in all the surrounding bay cities, and on clear nights will be visible in the sky for 40 or 50 miles. We have a great deal of fog here, and this will assist us greatly in producing wonderful lighting effects. In fact, the fog is one of the greatest assets we could possibly have.

We are going to have a new method of turning on the lights. The first effect you will notice will be myriads of little jets of light; the next effect will be the light breaking out from behind the columns; and the next will be the main white light jumping out. Then over the whole Exposition will play the rays of the scintillator, going through over 300 evolutions in

Exhibits Showing Effect of Light and Color, Pearls to Be Used in Illuminating Plan.

warm yellow in the lower sections. The upper sections will be bluish purple, producing an artificial shadow in light. The stars on the heads of the figures will stand out, and over all will be the light from the colors. The effects will be wonderful in these fogs, which can be used as a background to change the whole color scheme and soften the tones. We can produce almost anything we wish.

We want to have a locomotive, probably one of the New York Central locomotives, mounted on a steel bridge which will revolve. It has light, power, motion and advancement; it will develop power sufficient to send it 80 miles an hour. As it throws off steam and smoke, lights from the scintillator will be flashed on these two mediums, producing a beautiful effect.

The standards will be magnificent groups of lamps. The main courts will be lighted by two fountains, and controlled so that the light can be turned up or down. By means of our system of lighting we will be able to produce perfect reflections of whole buildings in the lagoons, instead of mere patches of light.

There will be no outline lighting; wherever it is necessary to emphasize we will use the jewels. Outline lighting has been done so often that it has come to the point where people say: "If you see one exposition, you see them all; we want something new and beautiful." In many respects this Exposition will surpass all previous ones; in the arrangement of the buildings, in making the buildings colored instead of white, and in the system of illumination. In this Exposition there will not be a single piece of lighting that was ever used before; everything will be new.

Power Data on International Expositions.

Exposition.	Area Enclosure in acres.	Total H.P. all purposes.	Total H.P. per acre Enclosure.	H.P. for Lighting.	H.P. for Lighting per acre.
Paris, 1889	173	5320	30.8	4000	23.1
Chicago, 1893	686	29830	43.5	11400	16.6
Paris, 1900	549	36085	65.7	13000	23.7
Buffalo, 1901	350	10000	28.6	1500	10.7
St. Louis, 1904	1240	44200	35.7	10000	8.1
Portland, 1905	400	12000	30.0	5400	13.5
Jamestown, 1907 ..	350	6680	19.1	5675	16.2
Seattle, 1909	250	13500	54.0	6700	26.8
San Francisco, 1915	625				
Average of all..	460	17846	36.5	6934	17.0

Lighting Data.

Exposition.	Incandescents.	Arcs.	Exposition.	Incandescents.	Arcs.
Louisville			Paris		
1883	3998	No	1900	76720	
New Orleans			Buffalo		
1884	3000	1500	1901	200000	
Paris			St. Louis		
1889	9075	1053	1904	142000	2000
Chicago			Portland		
1893	93040	3450	1905	100000	No
Nashville			Jamestown		
1897	18382	458	1907	124497	70
Omaha			Seattle		
1898	21000	No	1909	100000	No

Decorative Lighting Only.

Exposition—	Paris. 1889	Chicago. 1893	Paris. 1900	Buffalo. 1901	St. Louis 1904
KW. for lighting per acre of buildings	41.1	43.8	82.9	249	25

KW. for lighing per acres of buildings, average, 46.8.

The entire lighting is new in every respect, and it marks an epoch in illumination. The advance since the last big exposition in science and art of electric engineering and development of electric apparatus has been so great that we are now able to produce effects with economy which would have been physically impossible five or six years ago. In other words, the Exposition is to be a magnificent picture by night, with architectural splendor brought out to the best possible advantage in both form and color, maintaining the daylight perspective.

THE NEW AGRICULTURE.

The future of the West, aside from those advantages accruing from an intermediate location between European ports and the far east, must inevitably link itself with the productivity of its fertile soils. This future, indeed, spells the field of activity for the engineer in our Western Empire. The University of California, through its Board of Regents, has entered upon a proposed scheme of agricultural investigation and helpfulness never before undertaken in any place in the world. The California legislature will be asked this year to appropriate over a million dollars to forward this work. The very best brains the world has produced in this way of agricultural specialties will be engaged in this great work. Thomas F. Hunt has recently been installed as Dean of the Agricultural College at the State University to head this great movement. Below is an abstract of his speech at the recent dedication of the new two-hundred thousand dollar Agricultural Building at Berkeley.

If we take a hasty glance into the future we cannot fail to be impressed by the fact that the two great problems before California are to stabilize its water supply and humanize its labor supply. A few simple concrete illustrations may be better than much abstract discussion. In the Salt River Valley, Arizona, approximately ten million dollars have been expended, including the great Roosevelt Dam, to stabilize the water supply over 130,000 acres of already irrigated country and to bring 100,000 acres of the desert under the irrigation ditch. It was expected that this greatest reclamation enterprise in the United States would furnish about two dollars' worth of water per acre. In other words, a gross income per annum of about one-half a million dollars was anticipated. Although the enterprise has scarcely been completed in all its details, already it has contracts for one million dollars' worth of electric energy. It is said that there is nowhere any more livable region than in the foothills of the California mountains. Here can be developed unlimited power without the loss of any natural resource except the oil required to lubricate the machinery. In developing the power, the water in the valleys will be mobilized. When this is accomplished, California will have ten millions of people in place of two and a half millions. The slogan for California should not be one million persons for this or that city, depending upon which part of the State one is from, but two million families for California. Cover your hills and fill up your valleys with homes and the cities will take care of themselves.

California has rich river valleys whose conditions are like those which generations of Holland farmers have made famous. Canada has its agents in the lowlands inducing the Holland farmers to migrate to this northern country while our river valleys with their mild climate remain undeveloped. To develop this State with the least human sacrifice some selective process of locating people upon the land is needed. It is said that the farmers in the countries bordering upon the Mediterranean Sea are now saving their money against the time of the opening of the Panama Canal. When the thrifty Mediterranean folk come to our shore it will be the first time in the history of the world that these races have migrated to a country which was similar in its possibilities to their own. To entice these people upon land by means of "decoys" would be a social and economic crime. We need to study the history and adaptation of the peoples who now live in regions with natural conditions similar to our own. Instead of alluring the off scourings we should by some selective process secure the intelligent, thrifty, moral countrymen whose generations of experience will help to develop this country. When he arrives he should be located among natural conditions with which he has been familiar and protected until he has his industry upon its feet. It would be a form of protection that would protect. If you wish to compete with the peoples of the world you must develop in every locality that industry which naturally does best in that particular region, and you must put it in the hands of people who are most expert in that particular industry. By no other process can a state be developed to its highest efficiency.

The President and Board of Regents will be asked to establish a department in the College of Agriculture to be known as the Department of New Agricultural Industries. Already the United States Department of Agriculture and the State Experiment Stations have done splendid work in Plant Introduction. The introduction of a plant and the establishment of an industry upon that plant however are two widely different things. This department of New Agricultural Industries will not be a research nor a teaching department in the ordinary sense of the term. Its duty will be to study the agricultural industries of regions having conditions similar to California and to study our own state with reference to any industries which investigation may seem desirable to transplant. Last week we were told that Palestine is an exact counterpart of California except that Palestine is only one-tenth the size. Within this diminutive area, it duplicates the Sacramento and San Joaquin valleys, the valleys of the coast and the Sierra Nevadas and Coast Ranges. There is the same variation in climatic conditions and above all they have a four-thousand-year-old agriculture. No one knows what agricultural lessons this old world holds in store for us. Perhaps it may yet enable us to become the greater Palestine of a new civilization.

We have been discussing a century long program and a state-wide movement. Every man and woman in this audience will have been gathered in by Father Time long before our water supply has been fully stabilized and our labor supply fully humanized.

We are not now dealing with the individual, but with society. If society is not able to look beyond the confines of its individual members it is doomed to eternal damnation.

It may have occurred to some of you that the questions which have been discussed are beyond the realm of the institution which I for the moment represent. What has been said is for the purpose of emphasizing the fact that the University of California is perforce the leader of thought in all that relates to the welfare of the state and its College of Agriculture, if it is to be effective, must be the leader in all that relates to the development of agriculture. To fail to accept such leadership would be to fail to understand the responsibility that is placed upon it. Any other attitude upon the part of the people, whose child the institution is, would be reprehensible.

Unless the ranches of California are to be abandoned or are to be cultivated by foreigners, there are in California at this moment more than 8000 young men between the ages of 18 and 21 who will some day occupy the land. Less than six hundred are now receiving instruction in Agriculture in Berkeley and Davis. In a comparatively few years, a thousand students of agriculture will be enrolled at each place unless we do something to stop them. It should be determined at once what is the most efficient number that can be accommodated at Davis. It should be determined whether it is to be 300 or 600 or 1000. Plans should be made to start a new unit at Fresno as soon as the most efficient number that can be cared for at Davis is reached. At Fresno, where the university owns 5000 acres of land, there is an opportunity to build up the most extensive, most varied, and best instruction in horticulture, both for farm school and university, that is to be found in the world. No other such possibility exists anywhere. At Davis special emphasis should be placed upon dairying, animal husbandry and deciduous tree fruits. At Fresno, the emphasis should be placed upon grapes, citrus and other sub-tropical fruits and upon alfalfa and other forage crops. Instruction and investigations in cereals should be developed at both places. Under the conditions outlined a young man from Bakersfield or El Centro might go to Davis to receive instruction in animal husbandry and dairying, while the young man from Marysville might go to Fresno to specialize in horticultural subjects.

The tentative organization and scope of the College of Agriculture has been set forth with a good deal of tedious detail. I am frank to say that it has been done with a very definite purpose. The desire has been to make emphatic three points:

First—The College of Agriculture is located in California, Berkeley, Riverside, Whittier, Davis, Meloland and other places are merely points of operation. Los Angeles is the headquarters of the Santa Fe Railroad, but the Santa Fe Railroad is not located in Los Angeles. Last year the College of Agriculture met face to face 150,000 citizens of California.

Second—The work which is carried on at Berkeley, Whittier and Davis is not primarily for the development of the immediate localities, but is a part of a general scheme of education and research which looks toward promoting the general welfare of the commonwealth. The establishment of the Citrus Experiment Station is not primarily for the purpose of promoting the raising of oranges in Riverside County, but is for the purpose of studying problems which are of the greatest importance wherever agriculture exists under an irrigation ditch.

Third—Any additional points of operation which it may hereafter be deemed wise to establish must be considered from the standpoint of the general plan which has just been outlined and of the public welfare and not from the standpoint of local interest. I have faith that the people of California will rise to this high level.

The program which has been outlined is a large one. It is worthy of a great state. For its success it needs the help of every citizen. I believe it to be both logical and feasible. I asked for it the candid criticism of every person interested in the public welfare. With the assured and earnest support which this program has of the President and Board of Regents, I have faith to believe—and I am saying this in the most impersonal and detached way—that it must succeed.

I trust that President Wheeler was prophetic when he remarked several months ago: "I believe it will appeal to the people of California. They like to do a good thing."

PANAMA CANAL CONCESSION.

Probably one of the most interesting of the many great concessions that will be seen at the Panama-Pacific International Exposition is the production of the Panama Canal on a gigantic scale.

The concession will cost in the neighborhood of $250,000, and was granted to Lewis E. Myers, a well-known engineer of Chicago.

Mr. Myers is an engineer and not a showman. He visited the canal zone to study its construction and the idea came to him to perfect a means whereby the people of this country could learn more about it.

On his return to this country he proceeded to perfect and patent his ideas. He plans to truthfully reproduce the canal and the surrounding country in a weather-proof building, with a glass roof.

DECREASE IN NUMBER OF POLES PURCHASED.

While the total purchases of poles in 1911 was less than those for 1910 and 1909 by 452,674 and 320,720 respectively, it exceeded the totals for 1908 and 1907 by 168,866 and 134,752 respectively. The decrease in the 1911 totals as compared with that for the preceding year was confined entirely to a falling off in purchases by telephone and telegraph companies and steam railroads, while a substantial increase in purchases was made by electric railroads and electric light and power companies. The decrease in 1911 in purchases reported by the telephone and telegraph companies was not general, being confined in the main to states in which there was more than usual activity in the construction of telephone lines during 1910.

SCIENTIFIC PLANT MANAGEMENT

AN ANSWER TO CRITICISMS OF THE DIESEL ENGINE.

BY S. B. DAUGHERTY.[1]

A number of statements made in the article on page 384 in the issue of November 2, 1912, entitled "Recent Development of Diesel Engine Application," by J. W. White, Jr., leave in the mind of the reader an erroneous impression that will be harmful to a growing business and detrimental to the interests of power users in this country if they are allowed to pass unchallenged.

For the production of power by the combustion of fuel, no more efficient means has ever been devised than the Diesel engine, and if this engine is to take its proper place among prime movers in the United States it is essential that it be not charged with disabilities which are not inherent, and that the product of American manufacturers in this line be not condemned as wholly and irretrievably inferior to European built engines.

In the discussion of types, Mr. White outlines the relative advantages of the horizontal and vertical engines, but ends by saying that the single acting horizontal form is more liable to develop scoring of the cylinder walls and lubrication troubles, while these disadvantages would be absent in the same engine built vertically. Reference is undoubtedly made to the trunk piston type of engine.

But why build the horizontal trunk piston engine, when by increasing the weight and cost but slightly it can be made with a crosshead carried on an adjustable babbitted shoe, whereby the cylinder bore is left free to perform its proper function, and all of the connecting rod thrust and three-quarters of the weight is taken by the brosshead?

The magnitudes of these forces, when the ratio of the connecting rod length to the crank is as 5 to 1, are about as follows:

Weight of parts	6 lb. per sq. in. of piston area
Connecting rod thrust averages for the whole stroke	36 lb. per sq. in. of piston area
Total	42 lb. per sq. in. of piston area

In a trunk piston horizontal engine all of this comes on the side of the cylinder. For a piston seventeen inches diameter this average side pressure is about 9500 lb. In a vertical engine the side thrust due to the connecting rod is the same, and as it is six times that due to weight, the horizontal trunk piston engine carries only 16.6 per cent more side pressure than a vertical engine.

But with the horizontal crosshead type of engine all of this pressure excepting about 3½ per cent is transferred from the cylinder to the crosshead guide in the frame.

Among other advantages of the crosshead construction is that it is possible to make the wrist pin of a size more suitable for the load that it must carry. With a trunk piston it is not possible to make the wrist pin with a projected area of more than 25 per cent of the area of the piston. In most Diesel engines it is less. The result is that the nominal pressure on the pin per sq. in. of the projected area is four times the pressure in the cylinder or approximately 2000 lb. per sq. in. Its location within the piston where it is subjected to the heat radiated from the hot end of the piston is not conducive to satisfactory operation.

A specification of the Machinenfabrik Augsburg-Nuernberg A. G. giving the advantages of their horizontal engines over the vertical type of which they have built of the latter about 250,000 B.H.P., states that "it is well-known that the lubrication of the piston of a vertical engine is more difficult to effect than that of a horizontal engine. The unavoidable residues of burnt lubricating oil (oil coke) in the cylinder are in the case of the horizontal engine, pushed backwards into a cavity situated below the cylinder bore, wherefrom they are blown out by the blow off valve every time the engine is stopped. On the other hand, with a vertical engine, these residues make their way downward between the piston and cylinder thus causing seizing of the piston rings."

Long experience with horizontal gas engines of large size corroborates this. Lubrication of the piston is not difficult.

In the comparison of the two cycle and four cycle engines the two cycle engines are placed at greater disadvantage than is warranted. It is true that the fuel consumption of the two cycle engine is higher than for a four cycle engine of the same diameter and stroke, but the increase in fuel consumption is not necessarily 18 per cent, and is not due to poor scavenging. The indicated horsepower of a two cycle engine will for its effective stroke, (that is until the exhaust ports open) be equal to that of a four cycle engine. The loss in efficiency is due principally to the work that is required to compress a volume of scavenging air, that may approximate twice the displacement of the power cylinder, to a pressure of about five lb. per sq. in. On this account the fuel consumption per B.H.P. will range from 5 to 10 per cent higher than for a four cycle engine. It should be noted that the Diesel cycle is particularly well adapted to the two cycle type, for the reason that air alone is used for scavenging, and fuel is injected only at the end of the compression stroke. In the case of two-cycle gas engines the mixture of gas and air of a volume not greater than the capacity of the power cylinder up to the exhaust ports must do the scavenging.

Some of the mixture is lost to the exhaust. This is the reason that the thermal efficiency of the two cycle gas engine is not as high as the four cycle. Failure to appreciate this important difference in the op-

[1]Chief Engineer, Gas Engine Department, Snow Steam Pump Works, Buffalo, N. Y.

erating cycles of the oil and gas engines may lead to unmerited condemnation of the two cycle oil engines.

Under the caption "American vs. German Practice" Mr. White lists a number of features wherein German built engines are cited as being superior, compared with American practice. But what is "American practice?" To the writer's knowledge, there has been but one American built Diesel engine on the market until within a very short time past. That one firm has built a certain design that may not have proven the worth of all its distinctive features does not justify calling it "American practice" and then condemning it.

Some of the features cited, as for instance placing the exhaust port on the side walls of the cylinder, were not so designed on account of the difficulty of making heads to contain both inlet and exhaust valves, but rather with a view of bringing out a distinctive design. There is no question but that for a single acting engine the place for all valves is in the head, and it is more than probable that in the near future American practice will lean strongly to this design.

Now that the fundamental patent on the Diesel engine has expired manufacturers in all parts of the country are considering the building of these engines and some are ready for the market.

The screening of the inlet ports of foreign built engines is done for quite a different purpose than to prevent such small foreign particles as might be floating in the atmosphere from entering the cylinder, and that is to deaden the noise of entering air.

One prominent German builder makes the openings in the air intake pipe, narrow sawed slits not more than 1/32 in. wide. These are effective silencers but are not dust catchers. If cylinder walls become scored it is due to the piston seizing. This is caused most frequently from not having made proper allowances for expansion, in which case no method of lubrication can be effective in preventing cutting.

To what engines reference is made when it is stated that the air inlet is usually of the spring poppet type is not clear. Small oil engines are built in this manner, but they are not Diesel engines. The one American built engine which is referred to above has mechanically operated valves both for inlet and exhaust.

As to whether the air compressor should be driven direct from the engine or should be a separate machine is a matter of individual preference. Each arrangement has advantages but the latest designs of engines brought out in the United States seem to favor European practice, that is with the spraying air compressor, driven direct from the main shaft of the engine by means of a crank. It has the advantage of making each engine complete in itself, and not dependent upon an important piece of auxiliary apparatus.

In the paragraph on the oil spray it is stated that it is of the multiple port type on German engines, while on American engines it is most often done with a single jet. It is not clear to what particular design reference is made. From what the writer has learned from an inspection of a number of engines in operation in Germany and under construction in German shops, also from published descriptions, the single spraying valve per cylinder is the rule on all single acting engines. For double acting engines, on account of the rearrangement of valves necessary to allow for a piston rod, the clearance space is divided into two main pockets, one at the inlet and one at the exhaust valve. For such an engine two spraying valves are essential.

There is a design which might be called multiple ported. This is the spray valve which is used when very thick residues or tar is sprayed, the object being to provide for two kinds of oil, a light oil in quantity about 10 per cent of the whole amount required at full load and the balance of the cheaper heavy oil. The light oil is called ignition oil and is sprayed in ahead of the main charge. This arrangement requires two fuel pumps, one to deliver the constant quantity of ignition oil, and the other one under control of the governor, to furnish the variable quantity to suit the changing loads. Extra passages and valves must also be provided in the spray valve casing. European builders are experimenting with similar types of spray valves to take its place, and it is reported that they are meeting with success in these efforts to burn heavy oils without the use of the ignition oil.

The German mechanic is claimed to be of higher grade than the American, and to receive less wages. The latter is true. The former statement needs further proof. Because labor in Germany is lower paid than in the United States, it permits relatively more time to be spent on external finish for appearance only. Who will say that an oil engine will be more efficient if it has polished flywheels, polished cylinder head and foundation bolt nuts, and all of its valve operating mechanism draw filed and polished? Some European builders, under the influence of keener competition, are designing engines with a notable absence of these features. On all essential parts the standard workmanship in the best American shops is fully equal to that abroad.

Experience has proven that there is a wide variation in spray nozzle efficiency. The particular engines that have come under Mr. White's observation must have had very inefficient spraying devices, otherwise such compressions as 700 to 800 lb. would not have been found necessary in order to use 18 degrees gravity California oils.

Recent tests on the "Snow" engines with California and Mexican crudes of as low a gravity as 14 degrees Beaume have demonstrated beyond question that Diesel engines can utilize such oil with a compression pressure not exceeding 480 lb. per sq. in. The oil consumption at full load was .42 lb. per brake horsepower hour.

This removes what would have been a serious disability if it were desired to install oil engines in a plant already using a cheaper oil for steam generation. The main advantage is, however, in being able to dispense with the use of the light oil, which costs according to Mr. White, 41½ per cent more than the heavy oil now used under boilers. The engine running on this oil has a thermal efficiency of 33 per cent which is equal to the average efficiency of German engines using a higher grade of fuel.

With this efficiency and the lower cost of fuel used, the comparison of the Diesel engine and the

steam turbine installation is much more favorable to the oil engine than is indicated by Mr. White's curves.

Assume oil weighing 8.07 lb. to the gallon with .42 lb. of oil consumed per B.H.P. hour, and a generator efficiency of 90 per cent. One gallon of oil will give 12.9 kw.-hrs. at the switchboard. The cost per kw.-hr., with oil at 60c per barrel, is only .111 cents. Another factor favoring the Diesel engine installation is that on account of the relatively slight gain in thermal efficiency due to larger units as compared with steam turbines, a larger number of units could be installed. This would allow keeping as many engines running as are necessary to carry the load. When an oil engine stops its consumption of fuel ceases. In a steam plant, the fires must be maintained, involving a stand-by loss. The fuel cost per kw. output with oil engines could be kept almost constant instead of rising with lower load factors as Mr. White shows in the curve for fuel cost.

The Snow oil engine shows a relatively flat consumption curve. The oil consumption at half load is about 11 per cent higher than for full load. With a 1000 kw. station consisting of five units of 200 kw. each, the average fuel cost per kw. hour should not be more than 6 per cent above the full load rating, or about .118 cents per kw.-hr.

On this basis, the Diesel engine power cost curve crosses the steam turbine curve at about 30 per cent instead of at 75 per cent load factor. At 100 load, the power cost per kw.-hr. is about .57 cents as against about .675 for the steam turbine, or the cost of power with turbines is 18 per cent above the cost with Diesel engines as prime movers.

It is to be noted particularly that on account of the low cost of fuel the oil engine is at a disadvantage in this analysis, because, of the factors which go to make up the total power cost fuel is only about 20 per cent in the case of the oil engine, while in the steam turbine plant fuel is about 50 per cent of the total cost.

Assume 50 per cent increase in the price of oil, and the relative kw. costs become .845 cents for steam turbines and .629 cents for the oil engines, or 34 per cent higher for steam turbines than for oil engines. With the price of oil doubled the figures are 1.015 and .688 cents, or the cost steam turbine power will be 47.5 per cent higher than oil engine power. Stating it another way, doubling the cost of fuel increases the steam power cost 50 per cent while it only increases the oil engine power cost 20.5 per cent.

The cost of a Diesel engine plant installed would in the writer's opinion, be less than the cost assumed by Mr. White, namely $150 per kw., but the above comparison is made on his basis. A reduction of only 10 per cent in the first cost of the plant would reduce the power cost at 100 per cent load factor almost 6½ per cent, and relatively more as the load factor becomes less.

The cost of oil on the Pacific Coast is now low, but with the completion of the Panama Canal new markets will be opened. That the crude oil of 14 degrees Beaume gravity can be used in the Diesel engine with high efficiency and without troubles, will in itself broaden the market for the oil, and thus tend to advance prices.

In view of these facts, every one contemplating additions to existing power plants or the building of new ones should give serious consideration to the oil engine as a prime mover.

At the present time, four cycle engines can be furnished in powers ranging from 50 to 400 B.H.P. and two cycle engines up to 700 B.H.P.

FUEL CALORIMETRY.

BY. J. P. ZIPF.[1]

A fuel calorimeter, simple in operation and very accurate, has been designed by Professor S. W. Parr and is known by his name. The parts of this calorimeter are shown unassembled in Fig. 1 and assembled in Fig 2.

Unlike other calorimeters which use free oxygen, this calorimeter is supplied with oxygen by chemical reaction from sodium peroxide. For more vigorous action an accelerator is accomplished by an addition of potassium chlorate.

A well lighted closet should be used for all calorimeter work so that air currents, which might prevent uniform radiation, can be eliminated. The outside of the calorimeter cup and the fiber insulating case should be entirely free from moisture for the same reason.

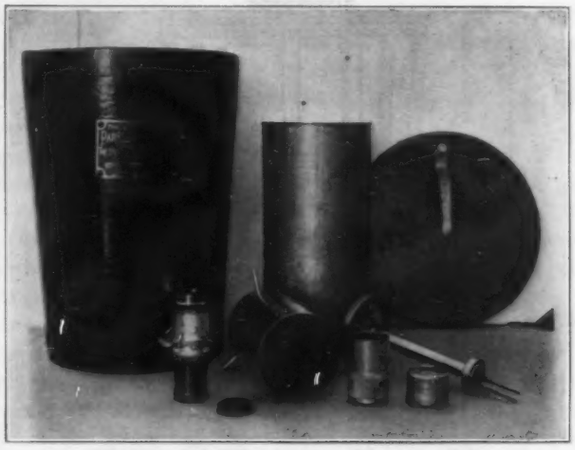


Fig. 1. Parr Calorimeter Unassembled.

The calorimeter cup is filled with 2000 grams of water, and together with the cartridge or boom has a water equivalent of 2135 grams. As the oil is also weighed in grams the term $\frac{\text{water equivalent}}{\text{weight of oil fired}}$ is a mere ratio, and if this ratio is multiplied by the rise in temperature of the water in degrees Fahrenheit, the result is heat units per pound of oil, or if temperature is expressed in degrees C. the result is calories per gram.

The water is best measured in a 2000 c.c. flask. About 2003 c.c. of water is used as the specific gravity of water at ordinary room temperatures is slightly less than 1.0.

The thermometer has a range from 65 degrees F. to 90 degrees F. and is standardized by the Bureau of Standards. Graduation errors are known to within .01 degrees F. The scale is divided into .05 degrees

and may be read with care to .005 degrees. The greatest chance for error in fuel calorimetry is in reading temperatures, parallax being difficult to avoid. As seldom more than 5 degrees difference is observed, an error of .01 degrees is equivalent to 0.2 per cent error. The cartridge should be wiped clean and dry immediately before use as moisture will condense on it if it has been standing some time. The top and bottom pieces, as well as the gaskets and electric terminals should be dry, moisture on them taking part in the combustion reaction, and introducing considerable error in the result.

The cartridge should be tightly assembled and 1,500 grams of accelerator, (potassium chlorate) weighed to the nearest .0005 gram, put in. The oil is weighed in a small flash, together with an eye-dropper and about 0.4 to 0.5 grams (8 to 12 drops) dropped into the cartridge on the accelerator, the latter absorbing oil. Upon reweighing the flask of oil and the dropper the weight of the oil is obtained by difference.

A measure full of sodium peroxide is added and the contents thoroughly mixed with a stiff wire. With care no oil, and very little peroxide will adhere to the wire. The sodium peroxide should be that supplied by the calorimeter manufacturer as inferior grades are apt to contain a variable and detrimental quantity of moisture.

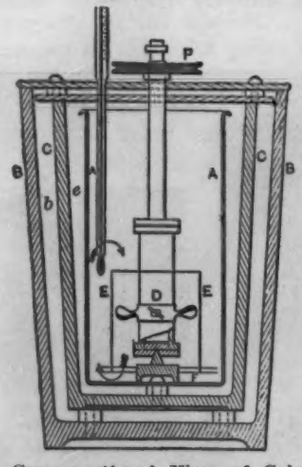


Fig. 2. Cross-sectional View of Calorimeter.

About 3 in. of No. 34 iron wire for firing the charge is looped on the firing terminals and tested to insure a good electrical contact. The firing current can be supplied by a few dry batteries or a storage battery.

The stem of the boom is fastened in place and the vanes attached. The cartridge is then placed in the calorimeter cup, the cover and pulley attached and the cartridge stirred by a small motor for about five minutes. The motor may be of the toy variety and placed in the lighting circuit with a lamp resistance. The system may be controlled with a two-throw switch, so that the motor may be cut out without interfering with the illumination in the closet. The motor speed should be as nearly constant as possible, as a variable speed will cause a variable rate of radiation of the calorimeter. The boom should have from 100 to 150 r.p.m.

The thermometer is placed through a hole in the cover and should be supported so that it does not touch the metal cup. After steady initial temperature has been reached, the firing circuit is completed through the pulley and temperatures read every minute for the succeeding ten minutes.

For a period of about five minutes the temperature will rise until a maximum is reached, after which the temperature will fall due to radiation. The radiation occurring during the first five (or less) minutes is assumed to be at the same rate as that observed during the radiation period.

This assumption is not quite true,[1] but it is nevertheless accepted, as errors are not greater than errors in temperature reading. Readings made during a calorimeter trial of the sample oil under consideration are as follows:

Weight of oil used	.3765 grams
Percent moisture	4.7% (by volume)
Weight of accelerator	1.500 grams
Room temperature	70° Fahrenheit
	Temperature
Time fired.	73.665° F.
Combustion Period.	
1 min.	77.40
2 min.	78.00
3 min.	78.27
4 min.	78.29
5 min.	78.30
Final or Radiation Period.	
6 min.	78.29
7 min.	78.27
8 min.	78.25
9 min.	78.235
10 min.	78.22

Of the heat generated 73 per cent is due to combustion of the oil with oxygen, and 27 per cent to reaction of products of combustion with the excess sodium peroxide. A great number of experiments show that factor .73 is accurate to within 0.1 per cent, regardless of the composition of the fuel. The corrections for reactions for the iron wire and potassium chlorate with the product of combustion are derived from data supplied by the manufacturer. The thermometer corrections are obtained from the Bureau of Standards comparison.

The computation is carried on thus:

$$\text{Radiation.} \quad \frac{78.30 - 78.22}{5} = .016° \text{ per minute.}$$

	Correction.	Corrected.
Maximum temperature 78.30	—.053	78.247
Minimum temperature 73.665	—.043	73.622
Total rise in temperature		4.625
Correction for chemical and wire		—.373
		4.252
Correction for radiation 6 x .016		+ .080
Rise due to fuel		4.332°

$$4.332 \times .73 \times \frac{2135}{.3765} = 17932 \text{ B.t.u. per lb. of oil as fired.}$$

$$\frac{17932}{.9511} = 18850 \text{ heat units per lb. dry oil.}$$

Three principal difficulties are encountered in the operation of the calorimeter:

[1]For errors in calorimetry and a more exact method of determining radiation refer to Journal of the Society of Chemical Industry, Aug. 15, 1910.

1. The charge fails to fire, which may be due to the following causes:
   a. The charge was not mixed.
   b. Oil was not placed in the boom.
   c. A poor electric contact.
   d. Not sufficient current to cause fuse wire to glow.
   e. The wire burned apart very quickly at a point not in contact with the charge. This may have been caused by a nick in the wire lessening its cross section.
2. Too high a fuel value.
   a. Water was present either as a drop in the cartridge, or as moisture condensed on the surface of the cartridge before the charge was put in.
   b. The cartridge was in poor condition or not tightly put together, either allowing leakage.
3. Too low a fuel value.
   a. Unburned carbon present due to insufficient oxygen. Either not enough accelerator was used or the charge was not well mixed, leaving a mass of free oil which remained unburned.

In operating any calorimeter considerable care is required, and even then results can not be expected with less than 0.2 per cent error. Thus the accuracy of the fuel value determination determines the accuracy of the efficiency of a boiler. Usually two or three trials are made with an oil to get more nearly an average fuel value, and as a check, one upon the other.

When working with an oil containing considerable moisture a water determination should be made in conjunction with a fuel value determination. Water in the oil makes fuel determination unusually variable.

FUEL CONSUMPTION OF DIESEL MOTOR VESSELS.

In a recent number of Denmark Abroad, a monthly review, there are published extracts from the ship and engine journal of the Diesel motor vessel Selandia. which some time ago completed its first round trip to the East. Following the extracts, the review states:

"The weather, especially on the return voyage, was unfavorable and the ship had full cargo both out and back. A steamer of the same size and running at the same speed would use three-fourths more coal, so that the fuel consumption is much cheaper for motor ships than for steamers, especially for those motor ships that can obtain their oil supply near the source of production.

"Aside from this, motor ships have a further advantage in that they can carry fuel sufficient for a distance four times greater than a steamer, and moreover, carry this fuel in their bottom tanks, so that they obtain more cargo room and save the time that it takes to run to ports to take on coal. In spite of the fact that the Selandia made a trip to London and remained there several days, it made the voyage to the East and back in less than four months, which is quicker than any other of the East Asiatic steamers has ever made this trip."

USE OF COAL, OIL AND GAS FOR POWER PURPOSES IN ENGLAND.

C. E. Stromeyer, chief engineer to the Manchester Steam Users' Association, has written some notes on the use of oil as fuel, as well as on the question of oil and gas in internal-combustion engines. In the following table he shows the price above which good coal would have to rise before it would be commercially profitable to burn crude oil instead of coal:

Fuel.	Prices.					
Crude oil, per ton...	$8.52	$9.73	$10.95	$12.17	$13.39	$14.60
Crude oil, per gallon	.035	.04	.045	.05	.055	.06
Good coal, per ton..	6.33	7.30	8.27	9.25	9.97	10.95

Even if the prices of coal and oil should come into harmony, the latter fuel is not quite so advantageous as would at first sight appear. With suitable sprayers the thermal efficiency is doubtless relatively high, but at best this will allow of a gain of only about 5 per cent, and against this has to be set the disadvantage that high efficiencies are associated with high furnace temperatures and also with such boiler troubles as bulges, grooves, etc., especially if the boiler water is at all sedimentary or greasy.

Roughly stated, a first-class modern steam engine utilizes about 12 per cent of the available heat in the coal, resulting in, say, 1.6 pounds to 1.7 pounds of fuel per brake horsepower per hour during a week's work of 55 hours. If the boilers are to be fired by producer gas, for which purpose slack and dust can be used, then each brake horsepower will require about 2 pounds to 2.2 pounds of coal. Internally fired gas and oil engines are approximately twice as efficient as steam engines, which means that they utilize about 25 per cent of the available heat. Crude oil being 37 per cent better than good ordinary coal, oil engines should use only about three-eights of the quantities of coal mentioned above, say about 0.6 pound per brake horsepower. Then, however, as there are no boiler radiation losses over night, a material saving results, and the oil consumption per week of 55 hours may be about 0.5 pound per brake horsepower. Gasoline and similar internal-combustion engines would require about 0.4 pound per brake horsepower. Gas engines have also about the same efficiency as oil engines; but as there is a loss of about 20 per cent in the producers, if these work day and night, and another loss of quite 10 per cent if they have to stand idle overnight, the efficiency of gas engines is only about 40 per cent better than that of first-class steam engines. The following table shows the relationship of prices of the various fuels, each column giving those prices at which equal economy would be achieved if any of the power processes mentioned are used:

Fuel.	Prices per ton.					
Crude oil for Diesel engine	$ 8.52	$ 9.73	$10.95	$12.17	$13.39	$14.60
Gasoline for Diesel engine	10.70	12.17	13.63	15.09	16.79	18.25
Coal for producer-gas engine	2.79	3.29	3.65	4.02	4.50	4.87
Coal for gas-fired boiler	2.07	2.31	2.56	2.92	3.16	3.41
Coal for steam engine	2.43	2.92	3.29	3.65	4.02	4.38

It ought to be profitable to work internal-combustion gas engines, for, although gas producers can be fed with very cheap fuel, the above list shows a profit even when paying 15 per cent more than for steam coal.

ELECTRICAL PUMPING AND IRRIGATION

Method of Construction of Concrete Linings.

BY B. A. ETCHEVERRY.

The details of construction in lining canals usually vary with the character of the soil, the size of the canal and the ideas and judgment of the men in charge of construction. There are two general methods. The first method of construction requires forms, behind which the concrete is placed. The second method requires no forms, the concrete being spread on the bottom, and sides of the canal much in the same manner as for sidewalk work. The first method is used when the side slopes are steeper than 1 horizontal to 1 vertical. The second method is used for side slopes of 1 to 1 or flatter. With slopes steeper than 1 to 1 the concrete mixture has a tendency to run down the slope.

Construction of Concrete Lining by Means of Forms.

This method has been used in British Columbia by the Fruitlands Irrigation & Power Company, near Kamloops, by the Kelowna Irrigation Company, and the South Kelowna Irrigation Company. It has also been used extensively on a number of canals in Southern California, and some canals of the U. S. Reclamation Service. It is well adapted to canals less than 8 or 10 ft. wide at the top. The method is as follows:

Form in Place for Earth Backfilling, Kelowna, British Columbia.

For a new canal the excavation is made about 6 in. larger on each side than the finished earth section when ready to receive the lining. For an old earth canal all vegetable matter is removed and if necessary more material taken out in the same manner as for a new canal. In each case the bottom is brought carefully to grade. To shape the canal ready for the lining, the means used on the canals of the Fruitlands Irrigation system near Kamloops, were wooden forms 6 feet long. The form is a trapezoidal trough with no bottom; the sides are tongue and groove or shiplap boards nailed to frames made of 2 in. by 4 in. scantlings cross-braced for rigidity. These forms are placed in position in the excavated section, earth is thrown in between the form and the earth bank and well puddled with plenty of water which was pumped for this purpose. This was found much better and more economical in labor than tamping the earth. Even when using a very wet mud the ground drains sufficiently to allow the removal of the forms next morning. This leaves a very smooth ditch with moist banks ready to receive the concrete lining.

To place the concrete, forms similar to the earth forms are used. This concrete form is smaller than the earth form by the thickness of the lining and is built so as to give a greater thickness of concrete at the corners where the floor and sides come together. The concrete work follows shortly after the earth forms are taken out when the banks are still moist. The concrete forms are placed in position in the finished earth ditch, but instead of placing them continuously in the earth forms, only every alternate form is put in place; then the concrete, which is mixed wet, is placed between the form and the earth and well stirred or cut with thin bars. To protect the earth slope when pouring the concrete mixture, it is well to cover the earth slope with thin galvanized iron sheets, which are pulled up as the concrete is poured in. The sides and bottom are put in at the same time. This gives a good connection at the corners which is very desirable. To do this it is necessary to block the forms above the ground by 3 in. (the thicknes of the lining). To hold the concrete at the ends of the sides and also to hold the form the right distance away from the earth side, 2 in. by 3 in. pieces are placed edgewise between the earth slope and the wooden forms. When the sections have hardened the forms are removed and moved ahead to the adjacent section. In order that the ends of the form will rest on the two adjacent completed sections, the forms should be a little longer than 6 ft. (the length of a section) preferably 6 ft. 6 in. After the removal of the forms the concrete must be prevented from drying out too quickly. This may be done by protecting it with burlap kept wet by sprinkling or by letting water in the completed section as soon as possible. It is preferable to keep the concrete moist for several days after the removal of the forms.

The proper handling of the forms, especially on rough side-hill work, will materially affect the cost. When the lining is started from the upper end of a canal and the work progresses downstream, probably the most economical manner is to place the forms in position for a length of canal which can be lined in one day and begin the concrete work at the downstream end and extend it upstream. The concrete at the downstream end hardens first and this allows the removal of the downstream forms, which are carried downstream in the ditch and placed in position at a distance from their previous position equal to the length of canal lined in one setting of the forms. This procedure allows continuous work and does away with

the necessity for carrying the forms around the side hill.

Joints.

The lining is done in strips in order that all contraction cracks will occur at the joints, which are places of weakness. To separate the sections more distinctly, the edges of the sections may be painted with oil or a strip of tarred paper may be used. By using short sections the contraction cracks are very small and the seepage through them is negligible. It is probable that the cracks in most cases will silt up.

Expansion Joints.

Ordinarily expansion joints are not necessary, but there are some classes of soil in which any seepage through cracks will cause the settlement of the soil and destroy the lining, in which case it may be desirable to do away with all open joints to prevent seepage by using some form of expansion joint. This, however, is quite uncommon, but occasionally occurs where the soil has probably been formed from the coarser material carried by the flood waters of a heavy cloudburst and deposited in small fan-shaped valleys or benches. The lack of rainfall and of the occurrence of further cloudburst has left the soil in an unsettled condition and any seepage water passing through the concrete lining may carry off the finer soil particles into the subsoil below and cause a settlement. For these conditions it may be advisable to use expansion joints spaced about 12 ft. apart and omit all other joints. However, the writer believes that the soil can be thoroughly settled by running water in the excavated canal prior to the construction of the lining. The expansion joint, if desired, could be made by imbedding in the edges of the adjacent section a metal tongue about 4 in. wide. This tongue may be of galvanized iron well painted with oil to prevent adhesion of the concrete.

Method Used Near Kelowna, British Columbia, by Kelowna Irrigation Company.

The method was very similar to the one described above. The main difference was that no separate earth forms were used. The concrete forms were placed in position in the excavated ditch and galvanized iron metal plates were put outside of the concrete form and held away from it by pieces of timber of the thickness of the lining. The earth backfilling was placed against these plates and the concrete was poured in between the plates and the concrete forms. The plates and pieces of timber were pulled out as fast as the concrete was poured in. The above methods of lining by means of forms are limited to side slopes steeper than 1 to 1, because when using a wet mixture even with side slopes between ½ to 1 and 1 to 1, the forms will tend to rise. Bolting the forms together will help to keep them in position.

Construction of Concrete Lining Without Forms.

This method of construction is used extensively for lining irrigation canals in California and other states. It is the method to use for side slopes of 1 to 1 or flatter and is well adapted to large canals. While the first method is usually preferable for new canals on side hills, because steeper side slopes can be used, the second method may be preferable in the valley or in level land and especially in loose sandy soil which will stand naturally on slopes of 2 horizontal to 1 vertical or flatter. The method used in preparing the excavated earth canal for the lining and in applying the concrete lining varies. One of the best methods, used by the Gage Canal Company, Riverside, California, is as follows:

Preparation of earth canal: Place the grade stakes 20 ft. apart along one side of the ditch at a distance of 1 foot from the top of the sloping side. Hold a level rod or cross section rod across the ditch with one end resting on the grade stake, set the corresponding grade stake on the other side and put the bottom stakes in position by measuring down from this rod. By means of these stakes the bottom is cut to grade.

Canal on Side Hill, Belgo Canadian Fruitlands Co., British Coumbia.

To trim the side slopes, iron strips 1 in. wide, ¼ in. thick and of suitable length are driven edgewise in the sloping sides 3 ft. apart, and extending up and down the slopes. The lower ends of these bars are placed in line by means of a line stretched between the bottom grade stakes and the proper slope is given to the bars by using a specially constructed slope level, which consists of a wooden rod on which a level bubble is placed, the bubble coming to the center when the rod is on the desired slope. The iron bars when in position, are guides for a sharp iron straight edge with which all irregularities are shaved off and hollow places filled in and well tamped. It is important to remove all deposits of vegetable character and the sides and bottom must be well settled to prevent the cracking of the lining. It is well to run water in the ditch before the ditch is prepared and lined.

The placing of the concrete should follow the trimming as soon as possible and if the channel is dry it should be thoroughly moistened by sprinkling. The concrete lining is built in alternate strips or panels. To place the concrete wooden guide pieces of the thickness of the lining are laid across the side slopes at the required distance apart which may be 3 ft. or more. The concrete is spread between these studdings and raked to about a uniform thickness, tamped and made smooth and level by means of a straight edge resting on the guide timbers. The floor is finished in the same manner.

LIGHTNING PROTECTION OF TRANSMISSION LINES

BY ALFRED STILL,
Member A. I. E. E., Inst. E. E.

Many papers and articles have been written on the subject of lightning phenomena as they affect the construction and operation of overhead electric power circuits, and the apparatus connected thereto; but in countries where thunder storms are violent and frequent, the interruption to regular service and the damage caused by atmospheric electric disturbances are still considerable, and much has yet to be learned of the nature of lightning and kindred phenomena before our knowledge of the subject can be said to be sufficient to guide us in the design of protective devices which shall be reasonably efficient at all times.

In this article, the writer does not claim to throw any new light on the subject of lightning protection; but he attempts to review briefly the present methods and apparatus which have proved to be of some value as a protection from the effects of lightning and electrical surges; and thus assist the designer of overhead transmission lines in the selection and arrangement of the most suitable protective devices.

Although our knowledge of lightning phenomena is still far from complete, it is generally agreed that a single stroke of lightning is of short duration, frequently not exceeding the one-thousandth part of a second. If an overhead conductor receives a direct stroke of lightning, the potential value of the lightning charge is generally so enormously in excess of the working pressure on the conductors that the lightning leaps over the insulators down the pole to ground. Any charge on the line, which is not sufficiently high in potential above ground to jump over the insulators, will travel along the line in both directions until it is grounded through a lightning arrestor or dissipated because of the ohmic resistance of the conductors. The frequency of such travelling waves will depend upon the natural frequency of the line, and may be of the order of 1000 to 5000 cycles per second. These high frequencies tend to limit the discharge rate of lightning, as the inductance of the line, apart from any choke coils purposely connected thereto, will check the rise of current. If the resistance of an arrestor or the path through which a discharge occurs, were zero, the current passing would be a maximum. If C is the capacity in Farads, and L the inductance, in Henrys, of unit length of line, then $\sqrt{\frac{C}{L}}$ is the quantity that Dr. Steinmetz has called the natural impedence of the circuit; and the maximum possible value of the current will be I max. $= E\sqrt{\frac{C}{L}}$, where E is the impressed voltage, which may be considered as something less than the pressure which will cause a flash over at the insulators.

The intense concentration of lightning disturbances is the cause of the difficulties experienced in protecting transmission lines by means of lightning arrestors; experience tends to show that an arrestor does not adequately protect apparatus at a greater distance than 500 feet; yet it is unusual to find arrestors on a transmission line at closer intervals than 2000 ft.

Disturbances are most likely to occur on exposed heights, and on open wet low lands; special attention should therefore be paid to lightning protection at such places.

Apart from the effects of atmospheric electricity, it is necessary to guard against the abnormal pressure rises that will occur on long transmission lines through any cause, such as switching operations, or an intermittent "ground." Over-voltages up to 40 per cent in excess of the normal line voltage can be produced by switching in a long line. High frequency impulses or surges are set up, which, in the special case of an arcing ground, may give rise to a destructive series of surges, a state of things which will continue until the fault is removed. An arrestor which may be suitable for dealing with transitory lightning effects may be quite inadequate to dissipate the charges built up by such continual surges.

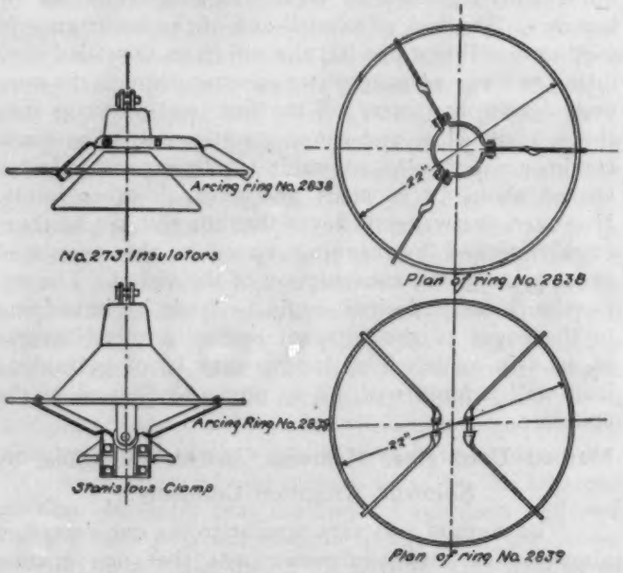


Fig. 1. Grounded Arcing Rings Attached to Standard Type of Insulator.

Protection of Overhead Systems Against Direct Lightning Strokes and Sudden Accumulations of High Potential Static Charges.

Under this heading the ordinary lightning rod and grounded guard wire will be briefly dealth with. If no guard wire is used, lightning rods should be provided at intervals along the line. They may be fixed to every pole or tower, but, in any case, they should not be spaced farther apart than 300 to 400 ft.; unless the spacing of the supporting poles or towers has to be greater than this, for economic reasons, it is especially important to provide them on the poles or towers in exposed positions such as hill tops. They should project from three to six ft. or more above

the topmost wire. A convenient form of lightning rod is a length of galvanized angle iron bolted to pole top or forming an extension to the structure of a steel tower. Long lines have been worked satisfactorily for extended periods without lightning rods or guard wires, but these are extra high pressure transmissions, which, on account of the better insulation throughout, are always less liable to trouble from lightning than the lower voltage systems.

Although engineers are still divided in opinion as to the value of the protection afforded by overhead grounded guard wires, carried the whole length of the line above the conductors, it is now generally recognized that this method of protection is efficient. The objections to the guard wire are the additional cost and the possibility of the grounded wire breaking, and falling across the conductors below, thus causing an interruption to continuous working. Trouble due to this cause is exceedingly rare, and at least one engineer (Mr. W. T. Taylor), with extended experience of transmission line work, has never experienced an interruption through the falling of a guard wire.

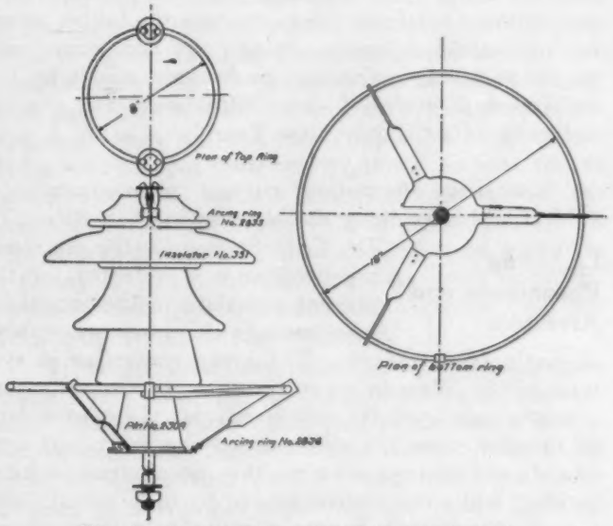


Fig. 2. Arcing Rings Showing Attachment.

It has been suggested that the guard wire or wires should be of the same material as the conductors, in order that the "life" of all the wires may be the same; but there are other considerations in favor of using a galvanized stranded steel cable for the guard wire. This may be the ordinary cable, 5/16 to 7/16 in. diameter, as used for guying poles; but where great strength is required, the Siemens-Martin steel cable, with or without hemp core, is preferable. Bessemer steel wire has not been found satisfactory for this purpose. In the case of the "flexible" steel tower type of line, a strong steel guard wire joining the tops of the towers, adds greatly to the strength and stability of the line, and may even, on long lines, save its cost, by allowing the use of lighter structures and fewer intermediate (dead-ending) towers.

In regard to the position of overhead guard wires relatively to the conductors, it is obvious that a number of grounded wires surrounding the conductors will afford better protection than a single wire above the conductors; and two guard wires are sometimes provided; but the additional cost is rarely justified. Perfect protection cannot be obtained even with two guard wires, and cases have been reported of lightning missing the grounded wire and striking a conductor situated immediately below.

The best position for a single guard wire placed above the conductors is, according to Dr. Steinmetz,[1] such that all the current carrying wires are included within an angle of 60 degrees below the guard wire. Additional wires can be installed in exposed positions, such as the summit, or very near the summit, of a range of hills, or by the shores of lakes or seas where the prevailing winds come over the water. In such positions, an additional guard wire on the side of the conductors may be useful. The guard wire should preferably be grounded at every pole, or at least every 500 feet.

As a special means of protecting insulators from the flash-over caused by lightning, or the power arc following a high potential discharge, the "arcing rings" first introduced by Mr. L. C. Nicholson, may be mentioned. These rings, which are grounded, are placed in such a position as to take the arc, and hold it at a sufficient distance from the porcelain of the insulator to prevent cracking or breakage by heat. The illustrations, Figs. 1 and 2, show the arrangement of the grounded arcing rings attached to standard types of insulator made by the Locke Insulator Manufacturing Company. It is not claimed that these rings will protect an insulator against a direct lightning stroke; but their utility on high pressure lines transmitting large amounts of power has been proved without doubt.

Methods of grounding.—The ground wire from lightning rod, guard wire, or arrestor, on high tension transmission circuits, should be as short and as straight as possible; it need not be of very low resistance; but small impedance is of first importance. The ground connection should have a large surface if possible, the material being of little importance, except that it is not wise to bury aluminum wires in the ground, because of possible electrolytic action. Galvanized iron is a good material. If the ground contact is made with one or more iron pipes buried or driven into the ground, these pipes may be from one to one and a half inches diameter, and a good connection should be made to the top of the pipe, as the inductive effect of an iron tube surrounding the ground wire might be considerable if a connection were made only at the bottom of the pipe. One or more pipes eight to ten ft. long, driven into the ground with 6 in. to 12 in. projection above, will generally be found more effective than buried plates. A very low resistance ground is not essential on a high tension system, and, generally speaking, the special forms of ground plate made of perforated copper, designed to hold, or to be in contact with, crushed charcoal, are unnecessary. If a plate is used, this should be not less than 12 in. square, and it may be of galvanized iron 3/16 in. or ¼ in. thick, buried as deep as possible in the ground; and, in all cases, an effort should be made to secure permanently damp soil for ground plates or pipes.

(To be continued.)

[1]Discussion of the Committee on "Lightning Protection," of the National Electric Light Association, May, 1908.

JOURNAL OF ELECTRICITY
POWER AND GAS

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Rialto Building, San Francisco

E. B. STRONG, President and General Manager
A. H. HALLORAN, V. P. and Managing Editor
ROBERT SIBLEY, Treasurer and Editor in Chief
C. L. CORY, Secretary and Special Contributor
A. M. HUNT, Director and Special Contributor

On Library Cars of all Southern Pacific Trains.

TERMS OF SUBSCRIPTION

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	"	3.50
Other Foreign Countries within the Postal Union	"	5.00
Single Copies, Current Month	each	.25

NOTICE TO ADVERTISERS.

Changes of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon of Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July, 1895.
Entry changed to "The Journal of Electricity," September, 1895.
Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1899.
Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

FOUNDED 1887 AS THE
PACIFIC LUMBERMAN, CONTRACTOR AND ELECTRICIAN

CONTENTS

Proposed Illumination of the Panama-Pacific Exposition, San Francisco—1915 ..... *Frontispiece*

Illumination of the Panama-Pacific Exposition 545
By W. D'A. Ryan.

The New Agriculture 549

Panama Canal Concession 550

Decrease in Number of Poles Purchased 550

An Answer to Criticisms of the Diesel Engine 551
By S. B. Daugherty.

Fuel Calorimetry 553
By J. P. Zipf.

Fuel Consumption of Diesel Motor Engines 555

Method of Construction of Concrete Linings 556
By B. A. Etcheverry.

Lightning Protection of Transmission Lines 558
By Alfred Still.

Editorials 560
"Pax Vobiscum" or Merry Christmas.
Lightning Phenomena and Arresters.
The New Agriculture and The Engineer.
The Exposition Illumination.

Personals 562

Meeting Notices 562

Bureau of Mines Publications 563

New Catalogues 563

Oregon Electrical Contractors 564

News Notes 565

"Pax Vobiscum" or Merry Christmas

Tradition tells us that the monks of the middle ages carried with their salutation "pax vobiscum"—peace with you—more than its literal interpretation. At this joyous season of the year the Journal would leave with its readers a peace, incident in the lives of busy men, significant of a year's work well spent. Indeed, it would wish to its readers that spiritual content, that rest of soul, which comes alone to the reflecting mind when surrounded by the ring of children's voices, exclaiming over the happy surprises left by "dear old Santa Claus"; to the reflecting mind, which echoes in its thoughts, the bright greetings of life's dearest friends; to the reflecting mind, which thinks again those words of tender messages sent from wife or sweetheart; and above all, to the reflecting mind which in the joyous celebration of this plum-pudding season of the year, sees in one's own inner self a deeper, fuller significance of the manly part he himself must play in the battle of life.

To you then, dear reader, the Journal would wish that for a day, you lay aside your busy cares. May you on this Christmas day experience the fullest meaning of the old monastic saying "pax vobiscum," and may this fullest realization be brought about by the enjoyment of a truly "Merry Christmas" and the anticipation of a "Happy New Year."

Lightning Phenomena and Arresters

Transient alternating current phenomena is a subject truly involving the severest mathematics. To Dr. C. P. Steinmetz, the engineering profession is indebted for the present complete mathematical development in this interesting phase of engineering theory. The great transmission systems of the West in many instances encounter severe disturbances from its subtle effects. Due to a lack of thunder storms, California for the most part represents the district wherein this phenomena is most lacking, while the district served by the Central Colorado Power Company, particularly that portion wherein electrical energy is conveyed over the roof of the continent—namely, the crest of the Rocky Mountains—may be said to represent the other extreme. In this latter instance, lightning conditions are peculiar and are not easily handled, since even the insulators are occasionally thereby shattered. On the whole, then, the development of Western long distance transmission of electrical energy has of necessity been forced to grapple with this problem and today a complete setting forth, in comparatively simple technical terms, of the progress made and the underlying principles involved, will be welcomed by our readers.

The district around the north of Lake Superior teems with real lightning troubles. Elsewhere in this issue, Alfred Still, chief electrical engineer to the mines department of the Algoma Steel Corporation of Sault Ste. Marie, Ontario, Canada, contributes the first of a series of three or four articles on this interesting and perlexing subject. The effect of the corona in dissipating energy in the air when the pressure rises above a certain critical voltage is well

treated in the recent proceedings of the American Institute of Electrical Engineers. Theories and practical developments relating to lightning protection, however, are indeed timely. Mr. Still, a practical engineer of the highest professional standing, puts the matter before his fellow engineers in such a manner that the essential principles involved are clear. His ideas should be of immense value in guiding the engineer in the selection and arrangement of protective apparatus.

The New Agriculture and the Engineer

History records the fact that many years passed after the formation of the American government before a "million-dollar congress" was produced. The California legislature, the controlling body of a commonwealth of the United States undreamed of as ever becoming of financial importance for over three-quarters of a century after the founding of the Union, will this year be asked to appropriate over a million dollars for agricultural purposes alone.

Frequent comment has been made in the columns of this journal relative to the growing uses of electrical energy in rural communities of the West. This gigantic growth is but the reflection of a far-reaching movement, which will not find its ultimate culmination until every hill and valley of that fertile productive country is put under cultivation. So vast and so varied has now become this movement that the Regents of the University of California, through its agricultural department, have decided upon a plan so sweeping and so comprehensive that every nook and corner in that great commonwealth cannot help but feel its uplifting, helpful influence.

"Hogs an' corn" are raised in northwest Iowa—in southwest Iowa the staples produced are "corn an' hogs." Indeed in any other part of that state and in fact in countless Eastern states little variation is found in agricultural pursuits within the particular confines of a commonwealth. How vastly different in that great empire west of the Rocky Mountains!! California alone—between its snow capped peaks to the north and its sun-lit deserts to the south—raises or is capable of raising practically every product possible to bring forth in the temperate and torrid zones. Hence the study of agriculture in the West has a deep and far-reaching significance.

Under the proposed scheme in California the very best and the most earnest investigators that the world produces are to be brought within its confines. Agriculture, in all its various ramifications, is to be scientifically studied and the most improved and profitable methods employed in developing this wonderfully fertile country.

This new undertaking means much to the West. Its life-giving influence, buoyed up by the stimulating effect produced, will be swept back from the borders of the great Pacific and the confines of California into every valley and possibly productive area west of the Rockies. It takes but little thought to fully appreciate what it will mean to the central station and indeed to the engineer. A new, broader field of endeavor will now be opened to him. The electrical and mechanical engineer of the future will find himself a close ally of the leaders in this great movement, if, indeed, he himself becomes not the leader.

The immediate duty of the agriculturist under the proposed regime is, through research and education,

---

The Exposition Illumination

The lectures given by W. D'A. Ryan, published elsewhere, are remarkable from a number of viewpoints. The exposition authorities have given another evidence that they intend to secure the best talent available. The beautiful lighting of Niagara, the remarkably brilliant achievements of the Buffalo exposition, the recent widely discussed scintillating effect of the General Electric Building at Buffalo—all attest his ingenuity. As Mr. Ryan is the illumination expert of one of the largest electrical manufacturers in this country, his appointment might give offense to any competitor large enough to be affected by the advertising thus secured by Mr. Ryan's employers. It is not generally known that when the exposition managers requested an expression of views on this point by the principal competitor, its local representative said at once that Mr. Ryan stood in a class by himself, and that the exposition managers would be derelict in their duty if they missed the opportunity to secure such a man, that his company would welcome Mr. Ryan's coming. Unfortunately such breadth of view often is conspicuously absent in so-called big business.

Mr. Ryan does stand in a class by himself in that his results, beautifully striking, are secured by the ingenious application of simple devices. His work at this exposition will fascinate here as it has mystified and delighted assembled multitudes elsewhere. His fellow engineers like to do him honor for what he is and for what he has done.

Great doers are seldom, however, talkers. Sometimes it is difficult for a man who has done things to accurately tell the reason why they were done, especially in giving an off-hand address. Some of the engineers who honor Mr. Ryan for what he is and what he has done can explain his lack of accuracy with regard to some minor theoretical details only on such an assumption. To state that the red color of a piece of glass is due to the fact that it is vibrating at the particular rate at which red rays vibrate is somewhat at variance with the present accepted theory of light. Or to fail to state the fact that the changing color combinations of a soap-film projection is a direct measure of bubble thickness in terms of the wave length of that particular color, indeed allows to pass unnoticed one of the most interesting phenomenon of nature. The satisfying of such a curiosity that leads one to delve into the underlying principles of every day experience, even though a practical application be not always in sight, differentiates the real student from the rule-of-thumb experimenter. All who have seen Mr. Ryan's charming results know that his working thoughts are as clear and as precise as are his beautiful effects. Though the true student regrets some of Mr. Ryan's untechnical statements, still his pleasing personality in the course of his informal talks, sweeps all before it.

PERSONALS

ITEMS FOR THIS DEPARTMENT ARE SOLICITED FROM ALL READERS

Geo. A. Gray of Chicago is traveling on the Pacific Coast representing Crouse, Hinds & Co.

P. B. Hyde of the Edison Company leaves shortly for an extended trip to Los Angeles and Southern California.

Miles Steele of the Benjamin Electrical Works is attending the Oregon Electrical Contractors' Convention at Seattle.

W. W. Hanscom returned to San Francisco last Wednesday after a three weeks' stay in Los Angeles.

W. F. Neiman has left for an extended trip over the northwestern division of the Great Western Power Company.

M. L. Scobie of the Pacific States Electric Company has returned to his desk after an enforced absence of three weeks due to a sprained ankle.

W. D'A. Ryan, consulting illuminating expert for the Panama-Pacific Exposition Company, left for the East last Tuesday via Los Angeles.

J. R. Bibbins, local representative of Bion J. Arnold at San Francisco, expects to leave for the East after January first to be gone several weeks.

A. H. Halloran, managing editor of this journal, is at Trinity Hospital, San Francisco, recovering from a successful but painful operation on his ear drum.

Roy T. Guppy, chief engineer of the Southern Pacific company's electrification work now under way in and about Portland, is a recent San Francisco visitor.

Portland, is a recent San Francisco visitor. After a brief visit to Los Angeles, Mr. Guppy will return again to his activities in the north, arriving Christmas eve.

J. B. Leonard, engineer, announces the demand for open hearth steel is increasing so fast the Pacific Coast Company cannot fill new orders now being placed for this product before April.

H. A. Barrie, general manager, and **E. R. Davis,** electrical engineer of the Pacific Light and Power Company of Los Angeles, arrived in San Francisco last Tuesday, leaving the same day for Fresno on business connected with the Big Creek project.

Arthur G. Munn, president, and **Stanley S. Stonaker,** secretary of the California Glass Insulator Company at Long Beach, Cal., arrived in San Francisco Sunday on a business trip. Mr. Munn reports a growing popularity for California glass insulators on the part of the railroads, telephone, telegraph and other Western consumers.

Santa Claus (Briggs) that jolly, jovial, genial fellow, visited the Jovian Meeting, Tuesday last, which was attended by sixty or more members. His sack contained many tokens for those present and of course "Lucky" Charlie Wiggins pulled the horseshoe, while "Shining Light" H. E. Sanderson and Frank Stone, "That Handsome Fellow," fell in for a pretty little hairbrush and mirror respectively. Then came Captain Jackson, with a little sword and Colonel Strong with his stimulator; C. C. Davis and his auto; and for dear Brother Hillis a watch and chain in recognition of his past record for attendance and promptness, while Will Berry was the happy recipient of a golf bag in token of his golfing propensities. Through the interest and efforts of W. S. Hanbridge, many useful and attractive capital prizes, consisting of electric pocket lamps, water heater, electrical games, cigar lighter, etc., were awarded to members holding lucky numbers.

OREGON SOCIETY OF ENGINEERS

The regular monthly meeting of the Oregon Society of Engineers was held Thursday, December 19. John T. Whistler, formerly of the Reclamation Service, gave a talk on "Some of Our Water Resources."

PORTLAND JOVIANS.

The regular Jovian Luncheon Club met at the Hazelwood at noon, Thursday (12th). The chairman of the day was Arthur Derby of Jno. F. Robeling Sons. The speaker of the day was Marshall M. Dana, and his subject was "Immigration, Present and Future, With Regard to Opening of the Panama Canal."

LADIES' NIGHT AT LOS ANGELES SECTION, AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.

The Los Angeles Section met Tuesday evening, December 17 at 8 o'clock. The meeting was entitled "Ladies Night" and all enjoyed a pleasant and interesting address by W. D'A. Ryan of Schenectady, who is the engineer now acting in a consulting capacity for the Panama-Pacific Exposition. Mr. D'A. Ryan spoke on "Illumination."

ENGINEERS' & ARCHITECTS' LUNCHEON, PORTLAND.

The Joint Engineers' and Architects' luncheon at the Portland Hotel, Tuesday, December 10, was presided over by W. H. Graves civil and hydraulic engineer. The speaker of the day was by Geo. M. Cornwall, editor of "The Timberman." He dwelt at length upon the necessity for a course in Logging Enginering being placed in the Oregon Agricultural College at Corvallis. The luncheon was well attended.

BIENNIAL MEETING OF THE ELECTRICAL COMMITTEE, NATIONAL FIRE PROTECTIVE ASSOCIATION.

The biennial meeting of the electrical committee of this association will be held in March, 1913, in New York City.

The provisions of the National Electrical Code as they now exist will be the principal matter for consideration, and it is requested that any desired change in, or addition to, the Code, also all sub-committee reports, be forwarded to Ralph Sweetland, Secretary of the Electrical Committee, on or before January 15, 1913, in order that they may be printed in the Bulletin, the committee and other interested parties thus having opportunity to consider the same advance of the meeting.

STUDENT BRANCHES OF A. S. M. E. AND A. I. E. E. TO TAKE INSPECTION TRIP.

Under the leadership of Robert Sibley, professor of mechanical engineering and editor of the Journal of Electricity, Power and Gas, the student branches of the American Society of Mechanical Engineers, and American Institute of Electrical Engineers at the University of California will make an inspection trip to various engineering undertakings in the State. The trip will start at Los Angeles at the opening of the second week in January. After visiting the big power plants of the Southern California Edison Company at Long Beach and the Pacific Light & Power Company at Redondo, a visit will be made to the oil fields and power plants in and about Bakersfield and the Kern River The final visit will be made at Fresno and the Big Creek project of the Pacific Light & Power Company. Those signing for the trip are as follows: Robert Sibley, Mrs. Robert Sibley, Geo. Gautier, M. E. Page, Roy Newton, Arnim Graff, G H. Hagar, J. A. Villegas, F. B. De Lano, Leland Weber,

Ray Hansen, C. I. Kephart, L. W. Doyle, C. L. Reed, Ralph Reynolds, H. K. Winterer, C. B. Merrick, R. A. Waite.

PORTLAND SECTION, A. I. E. E., MEETING.

The third regular meting of the Portland Section, A. I. E. E., was held in the Assembly Hall of the Electric Building, on Tuesday evening, December 17th, at 8 o'clock. L. D. Gilbert, member A. S. M. E., associate A. I. E. E., engineer for the Oswego-Portland Cement Company, presented the paper of the evening, the subject of which will be "Electricity as a Factor in the Development of the Cement Industry."

SEATTLE SECTION, A. I. E. E. MEETING.

The December meeting of the Seattle Section was held Saturday evening, December 14th, at 8 p. m. in the assembly room of the Chamber of Commerce, eighth floor of Central Building. P. D. Naugle, of the United States Navy Yard, read a paper on "The Installation and Operation of Wireless Apparatus," and prepared discussions thereon were presented by other members. A paper entitled "Notes on Modern Telephone Practice" was also presented by Messrs. T. F. Cales and L. P. Crim, of the Pacific Telephone & Telegraph Company. Interesting discussion followed the presentation of both papers.

PORTLAND SECTION, N. E. L. A., MEETING.

On the evening of December 10, fifty members of the Portland Section of the National Electric Light Association met at the Multnomah Hotel and listened to a discussion of the proposed Workmen's Compensation Act which will be submitted to the Oregon legislature in January, 1915. The proposed act was drawn up by a committee appointed by Governor West, consisting of representatives from the State Grange, labor organizations and employers and provides for an industrial insurance fund which will be maintained by companies who have workmen engaged in hazardous occupations. The payments to the fund will amount to three per cent of the monthly payrolls for laborers engaged in such hazardous occupations, the three per cent to be paid by the company. The employees, themselves, will pay one-half of one per cent of their wages and the state will contribute an amount equal to the employees so that the total payments received by the fund will amount to four per cent of the workmen's payroll. The schedule of allowances has been drawn up providing for various payments in cases of death, permanent disability, partial disability and for first aid to the injured. The fund will be in charge of three commissioners appointed by the governor.

The distinctive feature of this bil' will be, that unlike the Washington law it will not be compulsory. In cases where companies and their employes decide to take advantage of the compensation act an agreement will be made between the employer and his workmen and the employer will then arrange to make the necessary payments to the state fund. The proposed Oregon law differs from the Washington law also in that it has done away with various classification of risk and various rates of insurance therefor. The framers of the Oregon bill state that while there is certainly a difference in the character of the risks, yet no one in this country has gathered sufficient statistics showing what these differences actually are and it is not believed possible to incorporate them in the bill until such time as sufficient statistics are gathered to demonstrate the varying degree of hazard. Instead of calling for payments from 1 per cent to 10 per cent of the payroll, as in Washington where the payments vary according to the hazard, the Oregon bill will call for a flat four per cent contribution as outlined above.

A. I. E. E. RESOLUTION ON PATENT SITUATION.

The American Institute of Electrical Engineers, acting through its officers and board of directors, has passed a resolution urging congress to provide for a commission, made up of unbiased, independent, non-partisan men of such national standing as will command the respect of the whole country; and chosen from different walks of life; and not more than one from any one calling or interest; and serving without pay. Such commission to hold public hearings, and otherwise, as may appear to them best, to make a thorough and careful study of the American Patent situation, and to prepare and submit a comprehensive report and recommendations to Congress for such changes, if any, as may, as the result of their study, appear to them expedient, whether in the patent office, in the method of court procedure, or in the organic patent law, and recommendations as to the legislation they would propose for effecting said changes. Congress is also urged to hold in abeyance all proposed legislation affecting the patent system in whatsoever way until such time as the said commission shall have had ample opportunity to hold the said hearings, and make the said study and report.

NEW PUBLICATIONS BUREAU OF MINES.

Bulletin: Bulletin 49. City smoke ordinances and smoke abatement, by S. B. Flagg; 1912; 55 pages.

Technical Papers: Technical Paper 27. Monthly statement of coal-mine accidents in the United States, January to August, 1912, including statistics for 1910 and 1911, compiled by F. W. Horton; 1912; 24 pages. Technical Paper 29. Training with mine-rescue breathing apparatus, by J. W. Paul; 1912; 16 pages.

Miners' Circulars: Miners' Circular 9. Accidents from falls or roof and coal, by G. S. Rice, 1912; 16 pages. Miners' Circular 10. Mine fires and how to fight them, by J. W. Paul; 1912; 14 pages.

NEW CATALOGUES.

The Benjamin Electric Company has issued a booklet on their "Loktite" car fixtures. Under this heading fixtures Nos. 2377-2378, illustrations of which appear in the advertising section of this issue, are intended for single unit ceiling car fixtures with standard glassware, having 2¼-inch fitter. Shade is securely held in position by a special safety holder, in which the usual holder screws are replaced by three spring clips, forced into engagement by a cam ring. The latter, in turn, is bolted to the casing. It can therefore not jar loose. A 2-piece porcelain receptacle provided with lamp grip secures the lamp against loosening or falling. As shown in the accompanying diagram, the receptacle may be attached in two ways: (1) to a strap; or (2) directly to the car ceiling. Fixtures for form "O" position are regularly furnished with strap. The form "H" position is secured by omitting strap and using oak base block. Sockets used are National Electric Code Standard.

"Direct Current Railways of 1200, 1500 and 2400 Volts" is the subject of a most valuable bulletin (No. 4958) from the General Electric Company. After a brief introduction regarding the economy of the higher voltage, detailed consideration is given to the cost of electrifying four types of road with 1200-volt equipment as compared with 600 volt. This comparison gives most minute tabulations of all factors of first cost, fixed charges and operation and maintenance, showing a saving of from 10 to 20 per cent in the cost of electrification material in each case, as well as showing the reliability of the higher voltage. All the apparatus and equipment required is illustrated and described most carefully, the treatise concluding with about 90 pages of illustrated description of typical installations throughout the country. This brochure is so elaborate that it will be sent only to those to whom it will of immediate interest. To such it should form one of the most indispensible books ever published.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

THE RELATION OF THE OREGON ELECTRICAL CONTRACTOR TO THE UNDERWRITERS' INSPECTION WORK IN OREGON.

(Concluded.)

BY F. D. WEBER.

We are charitable towards the electrical contractor as we know the things he has to combat. The road he has to travel is not strewn with roses. Some of the things he has to contend with are the following:

1—Attractiveness of the business to amateurs.

2—Carelessness and ignorance among workmen.

3—Indefinite specifications furnished by architects.

4—General disposition of public to desire cheapness.

5—Competion among the contractors themselves—"cut-throat methods."

6—"Carpet bag" competition.

7—No state restriction as to license restrictions for contractors.

8—Lack of experience within the ranks of the contractors.

9—Faulty or incorrect inspections by inspectors.

10—Lack of co-operation among contractors.

11—The rapid changes taking place in the science of electricity.

12—Lack of co-operation between architects and contractors.

13—Lack of co-operation between the jobbing trade and the electrical contractors—as regards price protection.

14—Ignorance on the part of a high percentage of the electrical contractors as regards plain business methods and how to figure their legitimate profits.

15—Lack of pride in their work and business.

16—Lack of proper co-operation between central station and contractor.

A few samples of architects' specifications will show their loose methods:

Switch boxes to have dull, square brass plates with ebony buttons.

Make wiring complete, ready for connection; extra heavy fuse for electric iron.

Bell plate at front and rear door to match hardware.

The electric contractors to furnish a certificate from the Willamette Falls Power Company, which has been out of business for years in this state.

Wire building in a workmanlike manner, with the best insulated copper wire of sufficient size to supply the necessary voltage and in accordance with the city ordinance rules and regulations, and also those of the local electric light and power company.

All joints are to be well soldered and wrapped.

All wires must be insulated with approved earthenware insulators.

All outlets are marked by a circle on plans.

Wire building in the best manner for Devonial telephone and finish with No. 1172 telephone in each apartment (fifteen in all) and connect with main entrance, and finish there with Devonial No. 157, with fifteen buttons. All to be set up in first-class working order. Details for work to be gotten out later.

Let us pause for a minute and see what the future holds in store for the electrical contractor of Oregon. By deduction from the past we can see nothing but a wonderful improvement in the conditions surrounding electrical contracting. The formation in New York in November of the "Society for Electrical Development, Inc." composed of the National Electrical Contractors' Association, the Electrical Supply Jobbers' Association, the National Electric Light Association and representatives of some of the electrical manufacturers, sounds the first keynote of a revolution in favor of the contractor. In a few short years he will be proud of his business, if he also meets this movement in his favor and makes the most of his opportunities.

The use of electricity will become more universal. Rates must go down, and with the more efficient cooking apparatus that will be developed, a new field in this line will open up. Even in some of the European countries heating is done by electricity at the present day.

Therefore it is now up to the electrical contractor to get on a firm basis and assist in his own development.

One of the best methods, we believe, to adjust all troubles and business differences is for the Oregon Electrical Contractors to join the N. E. C. A., and through that organization start a campaign of education. There is a condition that should be handled in this state and it is this: We have one city, and may be shortly another, in which the inspector is the only contractor. Now how can a man inspect his own work? This is a hard condition for us to handle, but your association could do so very easily.

There is another practice among some contractors in Oregon which should be stamped out also by your association, and it is the practice of taking a contract to do a completed job at a stipulated price. The work is inspected and condemned. The contractor makes the necessary changes, after which the job is accepted and the contractor renders a new bill covering all the cost of the changes required by the inspection department. Many times suit is brought by the contractor, and it is an even chance whether he collects his bill or not, the courts being poor judges of this kind of practice.

There are many more that in time you can right, and in closing I desire to repeat that I, as inspector of the U. E. R. B., desire to always co-operate with the electrical contractors of Oregon in every way possible to improve conditions.

PROFFER OF ASSISTANCE FROM PORTLAND SECTION, A.I.E.E. CONCERNING ELECTRICAL CONGRESS, 1915.

At the last meeting of the Portland Section of the American Institute of Electrical Engineers, there was a considerable discussion as to what might be done by the Portland Section, as a Section, or by its individual members, in der to best assist in the work of the Committee on Organization of the International Electrical Congress.

It was the concensus of opinion that financial assistance would be most acceptable, and the secretary has written to Mr. Henry A. Lardner, vice-president on Pacific Coast Relations of the Committee on Organization of the International Electrical Congress as to the details of the financial problems which will have to be taken care of, and for advice as to the raising of funds and the uses for which the amounts raised will probably be put.

Mr. Lardner has replied that he has not as yet been officially advised by the Executive Committee members as to final plans for financing the Congress, nor just what will be expected of the local or Pacific Coast members of the Institute.

It is certain that the offer of assistance of the Portland Section will be most acceptable to the Committee on Organization, and it is a pleasant indication of the great interest in this endeavor of the American Institute of Electrical Engineers which is taken by the Portland Section, and in addition shows very kindly feeling toward the San Francisco Section, who naturally have the International Electrical Congress most thoroughly at heart.

NEWS NOTES

INCORPORATIONS.

SAN BERNARDINO, CAL.—Amended articles of incorporation have been filed by the Cucamonga Water Company by E. T. Wright, N. W. Sewell, J. C. Lynch, W. B. Nicholson and John Lynch. The concern is capitalized at $100,000.

ELKO, NEV.—The Elko-Lamoille Power Company has been incorporated, with principal office at Elko. The capital stock is placed at $100,000. The original subscribers are: J. G. Scrughan of Reno, Frank Fernald Sr., Webster Patterson, H. S. Taber, L. J. Wintermantel and B. G. McBride.

ILLUMINATION.

ALAMEDA, CAL.—Sealed bids will be received up to January 7, 1913, for the furnishing of electroliers, lamp posts and tops for the department of electricity.

MIAMI, ARIZ.—Work has been commenced on the installation of the first unit of the electric light plant to be located on lot 37, in the building in the rear of the Miami townsite company building.

REDWOOD CITY, CAL.—On January 24th, the people of this city will determine by their votes whether funds shall be provided for the making of much needed improvments and extensions of the street lighting system.

EL PASO TEXAS.—The Alpine Power Company has received a bill of lading for equipment for the new lighting system. The new plant will have a capacity of more than 3000 20 candle power lamps, and will be installed and in operation before Christmas.

NEWPORT, CAL.—Sealed bids will be received until December 30th, for $25,000 worth of municipal light bonds. Said bonds are 25 in number, of denomination of $1000 each, bearing interest at 5 per cent per annum, payable semi-annually, and are for the purpose of constructing a municipal light works at Newport Beach.

VENICE, CAL.—Proceedings have been started for the installation of ornamental concrete lamp posts from Marine street south to Horizon avenue, as far east as Central avenue. This will necessitate erection of 600 posts, each of which will be surrounded by a cluster of one large and 6 small incandescent globular lights.

ECHO, ORE.—The city council of Echo has granted a 20-year franchise to Joe Roth, of Hermiston, Ore., and James Ralph of Spokane to install an electric light system. The power will be generated from the Umatilla River at Hermiston. Work is to begin within 90 days and to be completed within eight months from date.

SAN FRANCISCO, CAL.—The engineering department of the Pacific Gas & Electric Company, 445 Sutter street, has prepared plans and is taking figures for the construction of a reinforced concrete building which will be erected at the foot of Market street in Oakland. The work is to be handled through the office of Mr. Parker of this city.

MEDFORD, ORE.—Because Medford, according to a statement of Mayor Canon, is paying a higher rate for electric lights than any city in the state, and because an amendment passed at the last general election gives councils the right to fix the rates, a committee has been appointed to submit a uniform rate to be charged by the Oregon-California Power Company.

SAN FRANCISCO, CAL.—W. D'A. Ryan, electrical engineer in chief for the exposition, and one of the foremost authorities on questions of illumination in the United States, has exhibited some of the wonderful innovations in lighting, which he has worked out, and which will be utilized for the first time at the Exposition. The exposition directors were given a lecture and demonstration and the ways and means committee and the women's board were also Ryan's guests. "A popular expression is to be heard nowadays that all expositions are alike, but in 1915 we are going to show the world that the Panama-Pacific International Exposition is the exception to that rule," said Ryan. "The lighting of the grounds and buildings of the exposition will mark an epoch in electrical science, and will have a world-wide educational influence in problems of illumination. Where, in former expositions, buildings were but outlined by lights or at the best brought out in patches by great flares of light, this exposition will be illuminated softly and evenly so that the light will enhance the beauty of the buildings and courts from an architectural standpoint. There will be no glaring light that will weary the eye and result in headaches, the illumination being practically all indirect and from masked batteries."

TRANSMISSION.

TROPICO, CAL.—Sealed bids will be received up to January 23d for the electric franchise applied for for heating, lighting and power purposes, to be maintained for 40 years.

LOS ANGELES, CAL.—Work has begun on the extensions of the Edison Electric lines west from La Canada, through the Holmes-Walton tract to La Crescenta and Sunland. The Edison Company is under agreement to the Holmes-Walton Company to have power at the pumping plant by January 1.

VISALIA, CAL.—The first of a series of suits have been filed in the Superior Court against property owners of Visalia, Tulare and Woodville districts, by the Pacific Light & Power Company asking for a right of way for steel towers upon which to carry their high tension electric power from Big Creek to Los Angeles.

KLAMATH FALLS, ORE.—The California-Oregon Power Company has finished the extension of its high-tension line from Dorris to Klamath Falls thereby completing a system of 435 miles of main line distribution in Southern Oregon and Northern California. Up to the present time Klamath Falls has been supplied from the company's local plant, on Link River, but the rapid growth of that city and section was overtaxing this, and it was found necessary to bring in electricity from the big plants at Klamath River and prospect work on the large dam at Ward Canyon, in Siskiyou county, is progressing rapidly; the false dam which diverts the Klamath River through a tunnel, drying the river bed, is nearing completion. A spur track has been built into the works, from the Klamath Lake Railroad, and the crushers and mixers have been put in place, so that the concrete runs directly to the working place. This diverting dam will be 150 feet high and 310 feet along the crest. The power house is being built to contain four 10,000 kw. units.

LOS ANGELES, CAL.—To furnish motive power for additional street railway lines in Southern California, the Pacific Light & Power Company is bringing hydroelectric power from the Sierras, 240 miles to Los Angeles. The immediate expenditure exceeds $10,000,000 and the total development contemplated involves twice that amount. Nearly 3000 men are at work now in the Big Creek region, pouring cement for the dams, at the rate of 2200 barrels a day. Ten miles of railroad system have been built for construction purposes. Progress has been so rapid that the initial installation will be

made August 1, next. At that time, 70,000 horsepower will be ready for delivery over the new line—almost as much as the present aggregate capacity of the company's hydroelectric and steam plants. Ultimately the Big Creek line will furnish 300,000 horsepower and all construction work has been done with that end in view. When the great work is complete it will furnish power sufficient for street railway lines more than three times as extensive as the present Pacific Electric and Los Angeles systems.

SALT LAKE CITY, UTAH.—In addition to supplying the Utah Copper Company with power for the operation of its mines the Utah Light & Power Company, recently organized by Electric Bond and Share interests, will also supply the power for the electrification of the Bingham and Garfield Railroad. The Utah company is the operating company which will succeed the Utah Securities Company and will be formed by a consolidation of the Telluride Power Company, the Utah Power Company and several power companies in Utah. The entire stock of the Bingham and Garfield Railroad is owned by the Utah Copper Company, and its bonds are convertible into stock of the copper company at $50 a share at any time before July 1, 1914. Bingham and Utah has about 42 miles of track and operates between the mines of the copper company and a connection with the S. P. L. A. & Salt Lake road at Garfield. A cut-off is now being constructed over Soldier Summit. The work of electrification is expected to be completed by July 1, 1913, the work being done by the General Electric Company.

TELEPHONE AND TELEGRAPH.

SAN FRANCISCO, CAL.—An extensive system of government supervision over wireless telegraphy has recently become effective, four months after the date of the enactment of the law. San Francisco and Seattle will be among the divisional headquarters.

PORTLAND, ORE.—Equipped with a wireless telegraph apparatus, by use of which it is expected to communicate with San Diego, Honolulu and other distant cities, the Portland Young Men's Christian Association has just established one of the first complete schools in the West for instruction in use of "wireless." It is said to be the most complete apparatus possessed by any Y. M. C. A. in the country, and the association has been a pioneer in the education of operators.

PORTLAND, ORE.—The cost of establishing an automatic or semi-automatic telephone system of 7000 main and 13,000 residence stations, including all material, construction, tools and supplies, and one main and eight branch fireproof buildings will be $2,987,967, according to the preliminary report of Frank B. Hall, telephone engineer employed by the city to plan such a system and estimate its cost. The report was submitted to the city council by Superintendent of Public Utilities A. L. Valentine, to whom it was rendered.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph company will retire the $5,000,000 two-year 5 per cent notes due on January 5 from the proceeds of the sale of preferred stock to the American Telephone & Telegraph Company. Of the $32,000,000 6 per cent cumulative preferred stock authorized and issued by the Pacific Company, the American owns $21,727,200. Of the parent company's holdings of preferred stock, $18,000,000 was purchased just before the California public utilities law went into effect, and a portion of the proceeds of this sale will be used to retire the notes. The $750,000 Sunset Telephone & Telegraph first 6s, due July 1, 1913, will be taken care of by the sinking fund, while the $2,500,000 consolidated 5s of the same company will doubtless be called at 105 on October 1, 1913, from the proceeds of the sale of $3,000,000 unissued Pacific Telephone & Telegraph bonds.

TRANSPORTATION.

PORTLAND, ORE.—Double tracking of the Oregon Electric between Portland and Garden Home has been started in earnest.

STOCKTON, CAL.—The Stockton Electric Railway Company has been granted the franchise to extend its Poplar street line into the Baldwin & Howell tract in the northwestern section of Stockton.

FRESNO, CAL.—That a bonus of $40,050 has been subscribed for the proposed railroad to the new townsite of Biola, adjoining the Barstow Colony, is the statement made by J. B. Rogers, who, with San Francisco people, is building the line. Rogers states that the instrument filed in the recorder's office on Saturday is somewhat misleading and that the $6350 bonus reported, was only that collected from individual land owners. He had put up a bond to assure the building of the road or the return of the bonus money and it was for this reason that the agreement was filed. The Villa Land Company, which owns the townsite of Biola has put up a bonus of $25,000 and the firms of Murray Inc., the Kerman Land Company and the owners of the Sycamore lands, have subscribed together, the sum of $8700. The other $6350 brings the total up to $40,050. Teams are now at work on the railroad grade, but the heavy grading will probably not start much before next week. The line is to be completed within six months from the time of the beginning of construction.

WATERWORKS.

OAKLAND, CAL.—Sealed bids will be received up to December 30th, for the construction of a water plant in portions of County Road No. 1008, Main street and Lincoln street in the Irvington Road District.

LOS ANGELES, CAL.—The Public Service Commission will decide this week under what law regulating extensions of water service it will extend the water service into Rodgers Park district. The board decided upon the extension, but left open the question which law shall be followed.

SANTA MONICA, CAL.—Anticipating the early arrival of Owens River water, Mayor Dow has signed a contract with Quinton & Cody, hydraulic engineers of Los Angeles, to furnish a statement at the earliest possible date as to how much should be paid the local water companies for their distributing systems. This will form a basis for a bond issue election.

OAKLAND, CAL.—The Alameda petition for the formation of an intermunicipal water district has been filed with Mayor Mott, providing enough signatures from the seven cities of the proposed district to ask the supervisors to call a special election. The petitions will be filed with the supervisors as soon as the petitions of San Lorenzo and Mt. Eden are sent in. The Berkeley petition was filed on Wednesday. The territory included in the petitions stretches from the Contra Costa county line on the north to Alvarado on the south. The district will have the power to condemn the plants and properties of the Peoples Water Company or the Union Water Company, to purchase land and to own and operate a water system.

OAKLAND, CAL.—C. W. Blabon, E. M. Fossing A. Hallen, J. A. Eveleth, L. Yates, A. C. Sanford and Miss Edna Taylor have filed a complaint against the Peoples Water Company. The complainants are residents of Peralta Park, Berkeley, and charge that when they asked for a water service the company offered to furnish a supply only upon condition that the residents of Peralta Park, at their own expense, install the pipes and mains. The complaint charges that the proposal of the company required that the pipes and mains become the water company's property. The complainants ask the Railroad Commission to compel the company to give service in Peralta Park. This complaint calls upon the Commission to exercise a power not previously invoked.